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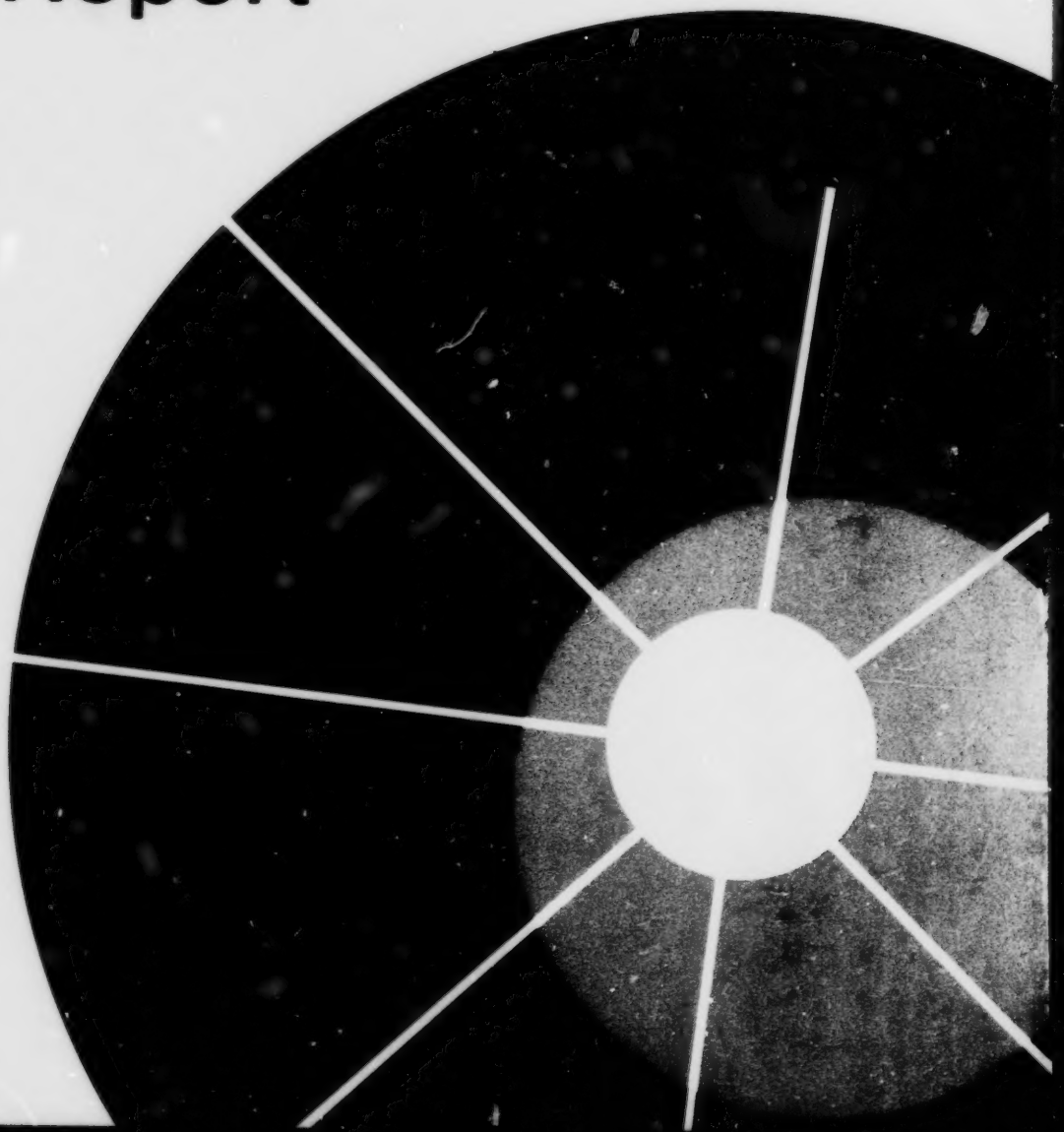
Canada - Saskatchewan Renewables — Conservation Demonstration Program

Final Report



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CANADA-SASKATCHEWAN CONSERVATION AND RENEWABLE ENERGY DEMONSTRATION AGREEMENT

On March 18, 1980, the governments of Canada and Saskatchewan entered into a Conservation and Renewable Energy Demonstration Agreement. The Agreement, which terminates March 31, 1984, funds the development and demonstration of a wide range of conservation and renewable energy technologies. The program is funded on an equal cost-shared basis by Canada and Saskatchewan, and is administered by Saskatchewan.

The objectives of CREDA are:

- To develop and demonstrate promising new technologies which exploit renewable energy resources, conserve energy, or make its use more efficient;
- To create employment in new or existing industries;
- To develop broad public awareness of the potential of renewable energy and energy conservation technologies.

This report outlines the results of a project funded by the Government of Saskatchewan as represented by Saskatchewan Energy and Mines, and the Government of Canada as represented by Energy, Mines and Resources Canada, under the terms of the Renewables-Conservation Demonstration Program, and contracted with the party identified herein.

However, neither the Government of Saskatchewan as represented by Saskatchewan Energy and Mines, nor the Government of Canada as represented by Energy, Mines and Resources Canada, accept liability for any errors, omissions, or inaccuracies that may; be included in or derived from this report, nor do they assume any liability with respect to the use of, or actions resulting from the use of, any information contained in this report.

Energy Audit: Yorkton Agriplex

SASK. 35

Retrofit of Recreation Facilities Project — Phase I

Final Technical Report
on a Renewables-Conservation Demonstration Program Project

Conducted By

de Lint Huckerby
Architects and Engineers

And Supported By

Saskatchewan Energy and Mines
and
Energy Mines and Resources Canada

Project Leader: Don Huckerby

Miscellaneous
Report FP-23

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* REVISED AUGUST 17 1982

RETROFITTING OF EXISTING
RECREATION FACILITIES PROJECT

PHASE I

YORKTON AGRIPLEX

INTRODUCTION

1. The Program:

This investigation and study was carried out by de Lint/Huckerby Architects and Engineers under the auspices of the Saskatchewan/Canada Renewables - Conservation Demonstration Program.

Hooker Engineering Ltd. was the sub-consultant for the mechanical work and Alfa Engineering Ltd. was retained for the electrical review.

An infrared thermal scan was considered imperative to assist in evaluation of the areas of heat loss and Thermo Focus Incorporated were retained to perform this function. A copy of their report is attached as Appendix I.

2. Categories:

The purpose of this study is generally to conduct a detailed energy analysis of the facility, identify energy losses and propose solution to these losses in five retrofit categories:
a) no cost retrofit - maintenance and operating changes (this has been assumed at less than $10,000 capital expenditures).

b) low cost retrofit - minor changes to structure or mechanical/electrical systems requiring low capital investments (assumed at less than $25,000).
c) medium cost retrofit - changes to structure or mechanical/electrical systems requiring moderate capital investments (assumed at less than $45,000).
d) high cost retrofit - changes to structure or mechanical/electrical systems requiring significant capital investments (assumed at over $45,000).
e) new and innovative retrofit techniques - changes or solutions which are not "tried and proven" but which potentially offer cost-effective savings to the energy consumption of the facility.

UTILIZATION

1. Facility History:

Construction for the Yorkton Parkland Agriplex was started about 1976 and the facility has been in use for some four years.

The Agriplex is heavily utilized as the program indicates, with a large variety of activities being held within the complex.

High energy consumption, however, has meant a high annual cost for this. There has also been continuing modifications to the structure to meet current fire and health regulations.

2. Building Description:

The Parkland Agriplex consists of the following general areas (see also attached floor plans and activity schedules for each area).

a) Ice Arena:

- The arena has a regulation size ice surface, complete with a concrete floor and artificial ice.
- Bleacher capacity is some 3,000 spectators.
- The entire arena is protected by a sprinkler system for fire purposes.
- Many off-season conventions, exhibitions and shows are held as well as the regular winter ice-related activities.
- The building is a Butler-type steel construction with rib roof, insulated with 2½ inches of fibreglas insulation having an R-value of about 7.7.

The upper wall is prefinished metal siding with an interior metal liner and 2½ inches of fibreglas having an R-value of about 7.7.

The lower wall is 8 inch lightweight hollow concrete block with zonolite loose fill insulation in the cores. The R-value of this portion of the wall is about 6.95.

b) Curling Rink:

- The Curling Rink has 8 sheets of regulation Curling Ice, a concrete floor throughout the ice area complete with artificial ice facilities.
- The ice area is fire protected at the window walls with a sprinkler system.
- The lower viewing area and the upper lounge and concession serve the Curling Club as well as hosting many off-season activities taking place in the main ice area.
- The building construction is similar to the arena, being of Butler type steel construction with rib roof and 2½ inch fibreglas insulation having an R-value of about 7.7.

  The upper walls are pre-finished metal siding with an interior metal liner and 2½ inches of fibreglas with an R-value of about 7.7.

  The lower walls are 8 inch lightweight hollow concrete block with zonolite loose-fill insulation having an R-value of about 6.95.

c) Swimming Pool and Whirlpool:

- The swimming pool is an indoor, year round 25 meter pool with a 3 meter and 1 meter board.
- A whirlpool, complete with an access ramp, is located in the same enclosure and is adjacent to the main pool.
- A full aquatic program is run on a year round basis.
- The enclosure for the swimming pool has a 3 inch tongue-and-groove wood roof deck on glue-lam beams. A built up roof is over 2 inches of fibreglas roof insulation with an R-value of about 11.97.

  The walls are 10 inch lightweight hollow concrete block with zonolite loose fill insulation with an R-value of about 6.95.

NOTES:

The quality of the vapor barrier is specified as "standard", not for "high humidity area" and therefore is suspect, and we have some concern about the possibility of dry rot in the wood deck.

- The "indoor/outdoor" nature of the glu-lam beams has given rise to distress at the support areas of the concrete block walls, and several vertical cracks have appeared in the walls. At the end of April 1982, some of these cracks suddenly increased in length, to some 15 feet long as well as new cracking became evident. The moving of the block walls is presently under investigation during the April pool shut-down.
- Distress at the top level of the hollow concrete block is also evident.

d) Convention Centre:

- The Convention Centre is located above the main floor lobby and hosts numerous conventions, dances, bingo games, etc. on a year round basis.
- A small food kitchen serves this area.
- The enclosure is an extension of the Curling Rink building and hence of similar construction.
- The floor and roof structure is supported by steel columns and beams.

3. MECHANICAL SYSTEMS:

GENERAL:

The Yorkton Agriplex consists of five distinct areas, the Arena, the Curling Area, the Pool and the Upper and Lower Concourse. The entire complex is served by one gas meter and one electrical meter making it impossible to measure the actual natural gas and electricity used in each of the five areas.

In order to identify and discuss each method of Energy Conservation as it pertains to the existing mechanical systems, we have divided the complex into the five aforementioned areas and dealt with each area separately.

The 1981 energy consumption figures for the complex indicate that 2,763,840 kWh of electrical energy and 6,130,313 kWh of natural gas energy was used during the year for a total of 8,894,153 kWh at a cost of $146,420.27.

With the building area at 87,519 Ft^2 the energy consumption for 1981 was 102 kWh/Ft^2.

The changes to the various mechanical systems throughout the complex that we are proposing will make the reduction of total energy consumption by approximately 30 to 40% a realistic target.

The savings of 40% in total energy saved represents a large dollar value, however, the cost of some of the more major changes also represents a sizable investment.

During our investigation of each of the five areas, we listed the proposed changes to the mechanical systems in one of the five categories as outlined in the introduction.

Because the five areas are all part of the same building some of the proposed changes overlap into more than one area and have been identified accordingly.

1. POOL AREA:

General:

The existing pool area consists of an indoor public swimming pool, a whirlpool, and washroom areas including showers and lockers.

The pool is 82'0" x 42'0" wide with a total surface area of 3,444 ft^2. The whirlpool is approximately 16' x 10'.

The pool area receives a very high usage, several hours a day, seven days a week, on a continuous basis.

The pool equipment consists of a natural gas fired heater, Teledyne Laars AFJ/560-1 with an input of 560,000 BTU/hr, a Diatomaceous Earth Filter, a 7.5 HP circ. pump.

The whirlpool is complete with an electric heater, 25 kW, 600 Volt, a sand filter, a 5 HP circ. pump and a 3 HP air pump.

Operating Conditions and Procedures:

A) The supply air system consists of a direct fired unit, Engineered Air Model HE-220-HMC, 2110 MBH input maximum, 72 MBH input minimum, and four (4) indirect fired duct heaters, REZNOR ITT Model X-350-3-5H, 350 MBH in/280 MBH out per unit. The supply air fan has an output of 15,500 cfm and is complete with a 15 HP fan motor. The duct system is set up with dampers and controls to allow the supply air to be 100% R/A, 100% fresh air, or a combination thereof. Tied into the supply air system are three (3) large side wall exhaust fans with a total capacity of approximately 15,000 cfm. This system heats the pool area and keeps the humidity in the space at an acceptable level, 40% maximum.

The change room supply and exhaust air system consists of a make-up air unit bringing in 4,300 cfm to the area and an exhaust system removing 2,400 cfm. The supply air not being exhausted by the washroom exhaust system finds its way into the pool area and out through other exhaust systems.

The exhaust air fan and the supply air system would appear to run continuously, 24 hours a day.

The supply air unit that is involved in this system also supplies air to the upper and lower concourse area.

The change rooms also contain two shower areas which draw the required domestic hot water from a natural gas fired water heater located elsewhere in the building.

B) The pool and whirlpool circulation pumps run on a continuous basis, the whirlpool air pump on demand only. The pool area heating, ventilation and dehumidifying system runs on a continuous basis.

C) The whirlpool water temperature is maintained at 105°F, the swimming pool between 85°F and 86°F.

The air temperature within the pool area is maintained at 85°F, although during severe winter conditions the air temperature does drop as low as 78°F.

D) The pool area is complete with a thermostat and a humidistat to control the space conditions.

During a site inspection we were unable to establish what, if anything, either of the controls did. The setting of the thermostat seemed to have no bearing on the space temperature and the humidistat did not appear to control anything. Upon further investigation, we found that a discharge air temperature controller located in the supply air ductwork just downstream from the last duct heater in fact controls the space temperature. In order to alter the space temperature, the operator is required to go to the mezzanine fan room and adjust the discharge air control. The intended operation of the humidistat was to cycle the main exhaust fans when the humidity within the pool area reached a predetermined level.

2. ARENA AREA:

General:

This area is complete with an artificial ice surface, spectator seating, change rooms and washrooms, tractor storage room, and an ice melting pit.

The main arena area is heated by means of two (2) gas-fired (indirect fired) furnace units, each one an Engineered Air Model TD-3001 with an input of 1,200 MBH.

The entrance and exit ways to and from the arena are heated with electric fan/coil units.

The change rooms and washrooms located around the perimeter of the building (under the seating structure) are heated by means of electric radiation.

The tractor room located at the northeast corner of the building is also heated electrically and the room is complete with the "melt pit". The snow and ice that is scraped from the arena ice surface is placed in this pit and melted by using domestic hot water.

3. CURLING ICE AREA:

General:

The existing Curling Area is heated with 6 x 25 kW electric unit heaters. Each unit heater is controlled with a remote thermostat and the temperature in the space is maintained at approximately 29°F to 30°F minimum. The electricity to the unit heaters is simply turned on in the fall and off in the spring of the year. The unit heaters maintain the set point on the thermostat on a continuous basis.

The humidity in the Curling Rink is controlled by means of operating two (2) side wall exhaust fans with fresh air intakes. The exhaust fans are controlled by a time clock and run only during occupied periods.

4. UPPER AND LOWER CONCOURSE AREAS:

General:

These areas are heated with natural gas fired equipment, also the make-up air supply to this area is by means of a gas fired furnace.

4. ELECTRICAL

GENERAL DISCUSSION:

Electrical energy is the product of two factors: Power (normally measured in Kilo Watts) and Time (hours). Saskatchewan Power electrical billings are based upon two charges: Electrical energy charge and the maximum monthly registered demand (Peak Power Demand).

Lighting and equipment efficiency can therefore be accomplished by reducing power (using fewer lamps, dimming, less equipment), by minimizing on-time (turning off equipment, lighting, heaters, etc.) and by reducing the Peak Power Demand.

To address only one of the factors, POWER, TIME or PEAK POWER DEMAND and not the other necessarily means that efficiency is not optimized.

Lighting systems give out heat (only 20% of the energy supplied to a fluorescent lamp is converted directly to visible radiation). This heat can be an advantage in the heating season in certain building locations, and a disadvantage as an additional cooling load in the cooling system. The impact of any lighting revisions on total building energy consumption will, therefore, not be confined to electrical energy consumption for lighting, but will interact with and alter heating and cooling loads.

Power factor is the name given to the ratio of the real or usable power measured in KW to the total power (real plus reactive or magnetizing) measured in KVA. Instantaneous power factor = cosine of the power factor angle = $\frac{KW}{KVA}$ and it is usually expressed as a percentage.

Transformers, induction motors and lighting using iron cored ballasts or any other electro-magnetic devices must be magnetized in order to function. The current through each of these devices consists of two components - real and reactive. The real current does the useful work and develops the power required, while the reactive current magnetizes the device. The total current is the vector sum of the real current and the reactive current. The power factor of a system may be described as either lagging or leading depending on whether the reactive current is inductive or capacitive.

a) Correcting Power Factor

Lagging power factor can be corrected by connecting capacitors to the system. The current which flows in a capacitor produces a leading power factor. This current flows in the opposite direction to that in an inductive device. When the two circuits are combined, the effect of capacitance tends to cancel the effect of inductance.

Figure 1 and 2 show the power factor diagrams before and after the addition of capacitors. A properly chosen value of capacitance can nullify the inductance and produce unity power factor, but too little or too much capacitance must be avoided. Two little will not correct to a sufficiently high power factor

and too much will cause the power factor to deteriorate in the leading mode with the same undesireable effects.

b) SPC Power Factor Policy:

Customer loads having poor power factor results in less than efficient use of both the customer's and the Corporation's electrical facilities.

When loads exceed 75 KW demand (billed under the General Service IV, V, or VI rate structure) the Corporation compensates itself for the wasteful effect of a customer's poor power factor, by the use of KVA - Demand metering; therefore, poor power factor loads result in higher than necessary demand registrations and subsequently higher electrical costs to the customer.

We recommend that a power factor check of peak loading is monitored and where feasible install capacitors to improve the power factor to the optimum 95%.

The full load power factor of a motor varies with the design. The new designs have a higher power factor than the older types.

Systems with continuous motor loads require capacitors on line at all times - fluctuating motor loads require capacitance which is also switched on and off. This switching of capacitors can be achieved by having the capacitors connected to individal motor circuits to alternately, installing a power

monitoring system which automatically engages or sheds capacitors in stages (for example 12 separate banks).

c) Payback

When power factor correction is properly applied under SPC billing conditions, our experience has shown that a pay back period of less than three years is common.

d) Other Benefits of Power Factor Correction

When power factor is improved, the reactive current flowing through the system is reduced, thus reducing transformer and distribution system loads, and releasing system capacity. Figure 4 shows the system capacity released as a function of the amount of correction.

Another benefit that results from power factor improvement is a reduction of conductor volt drop and improved voltage at the equipment, (resulting in increased motor efficiences).

Figure 3 outlines a simplified pictorial of a typical plant motor operating at 87% power factor (Sketch A) versus the same motor operating with capacitors installed at 96% power factor (Sketch B) - Note the amperage differential in both installations. SPC Billings are based on KVA charges (volts X amps) with the voltage remaining generally constant in both instances and as such the amperage is in direct ratio to energy costs.

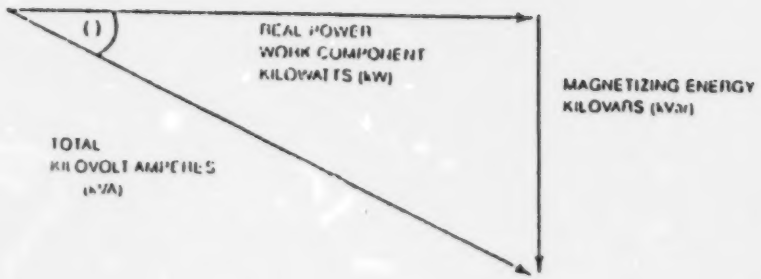
The amps coming from the plant distribution system are paid for on a continual SPC billing while the amps coming from the capacitor (sketch B) are paid for only once (in initial installation costs). Note the additional amps that are freed for use elsewhere (sketch B). Figure 5 shows a typical single line diagram and how power factor correction capacitors have been applied. Note that for large motors the capacitors are installed directly at the motor terminals, while for smaller motors the capacitors are installed on the main electrical bus.

It must be kept in mind that:

a) System power factor should be maintained at or greater than 90% lagging.
b) Motor size should closely match the load it will carry.
c) Capacitors or synchronous motors when properly applied are the main components used for power factor correction.

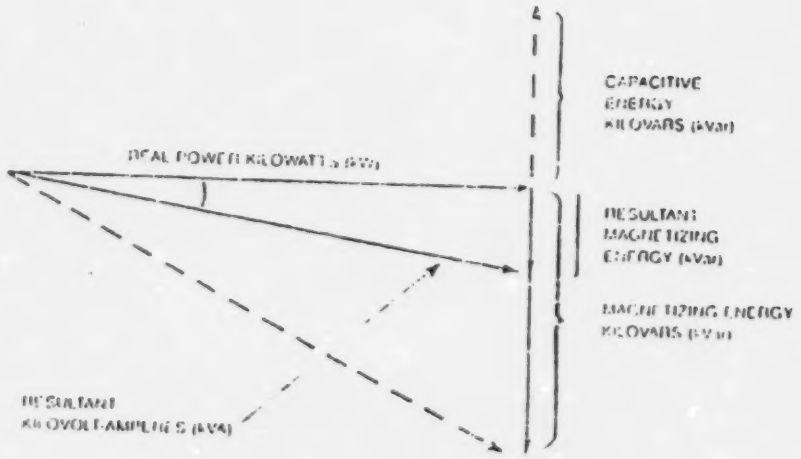
The advantages of improving power factor to 90% or better are that:

a) Lower power bills.
b) System capacity is released for expansion.
c) Voltage at equipment is improved.



Power Factor Diagram before addition of capacitors.

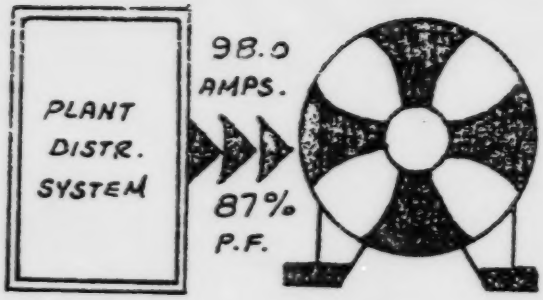
Figure 1



Power Factor Diagram after addition of capacitors.

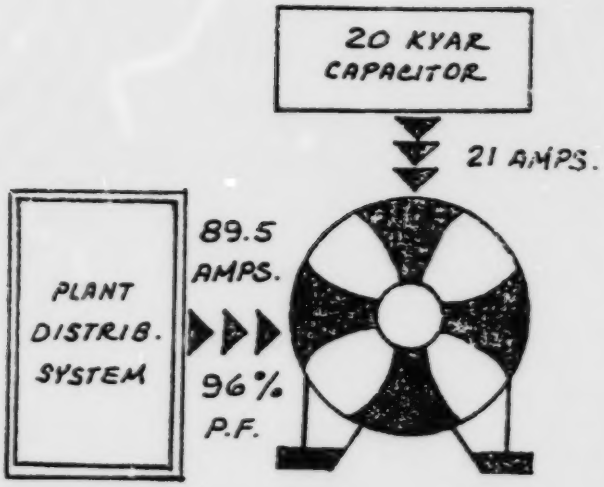
Figure 2

CAPACITOR NOT INSTALLED
SKETCH 'A'



100 H.P.
550 V.
1800 R.P.M.

CAPACITOR INSTALLED
SKETCH 'B'



100 H.P.
550 V.
1800 R.P.M.

CAPACITOR FUNCTION IN
POWER FACTOR CORRECTION
SIMPLIFIED PICTORIAL

Figure 3

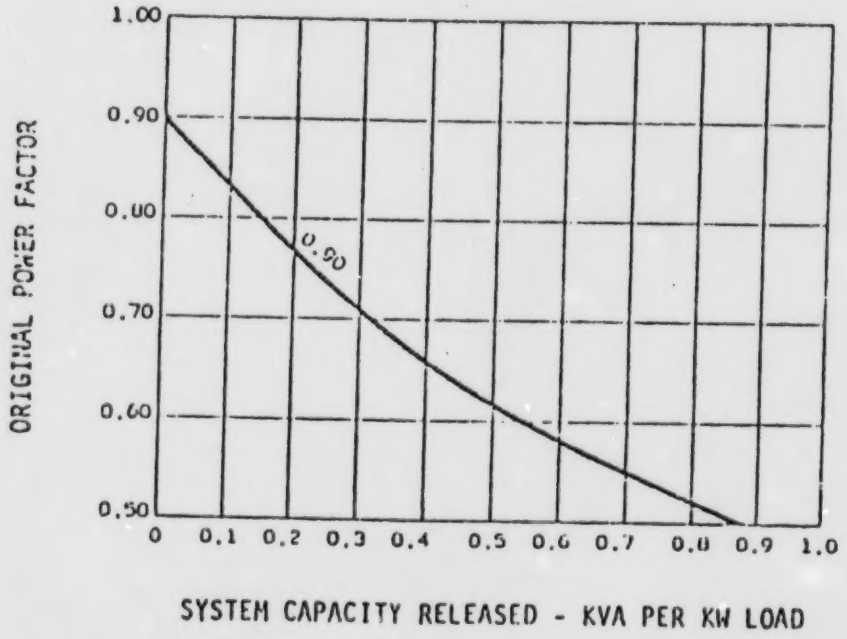

ORIGINAL POWER FACTOR
1.00
0.90
0.80
0.70
0.60
0.50
0.90
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
SYSTEM CAPACITY RELEASED - KVA PER KW LOAD
Released System Capacity
kVA Per Kilowatt Load

Figure 4

Power Factor Calculation:

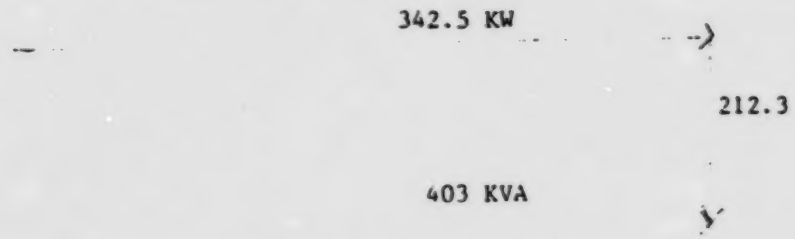
Measured in September - all lighting in ice refrigeration equipment on, electric heaters off.

Measured peak KVA = 403

Power factor = .85 = cosine angle = $\frac{KW}{403}$

KW = 342.5

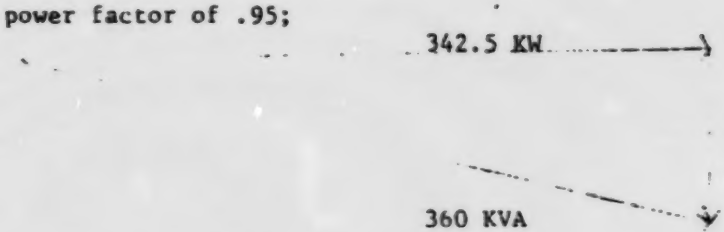
KVAr = 212.3



Cosine angle = .85

therefore angle = 31.48 degrees

For a power factor of .95;



Cosine angle = .95 = $\frac{342.5}{KVA}$

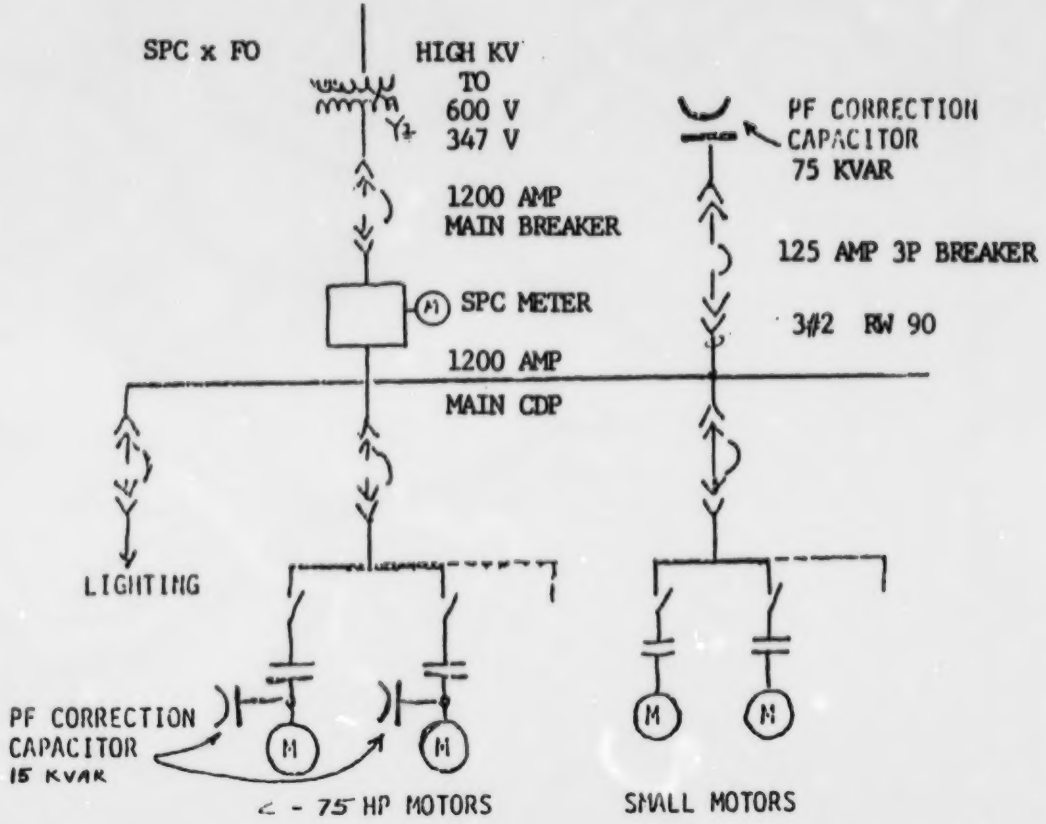
KVA = 360

Angle = 18.1 degrees

Sine 18.1 degrees = 310 = $\frac{KVAr}{360}$

KVAr = 112

Therefore, 212.3 - 112 = 100.3 KVAr, the capacitive reactive power required to correct the power factor to .95.



ELECTRICAL SINGLE LINE DIAGRAM

Figure 5

From the calculation, we require a total of 100 KVAr. When we review the electrical distribution, we see that in order to accommodate the fluctuating loading, two - 15 KVAr capacitors circuited to the two compressor motors and one 75 KVAr capacitor will provide good overall performance.

Two - 15 KVAr capacitors @ 600	= $1,200.00
One - 75 KVAr capacitor	= 2,400.00
Approximate Cost	= $3,600.00

Due to the widely varying load demand on this project, the power factor is constantly changing.

An approximate estimate is:

Existing Demand - 403 KVA
Projected - 360 KVA

43 KVA saving per month
x 12 months = 516 KVA
/annum x $6.65
$3,431.40

Power faccor projected savings for demand charges:
$3,431.40 + 10% surcharge + 5% E & H Tax = $3,963.26

Payback period = $3,600.00 / $3,963.26 = .9 of a year.

Daily Load Profile

A daily load profile will graphically illustrate your energy demand during a 24 hour time period. By seeing where your maximum demand occurs during the day, it is possible to determine what contributes to this high demand and where savings can be made. To draw your own daily load profile, you must hourly record the numbers registered by the red pointer on the demand scale. These numbers can then be plotted on a graph.

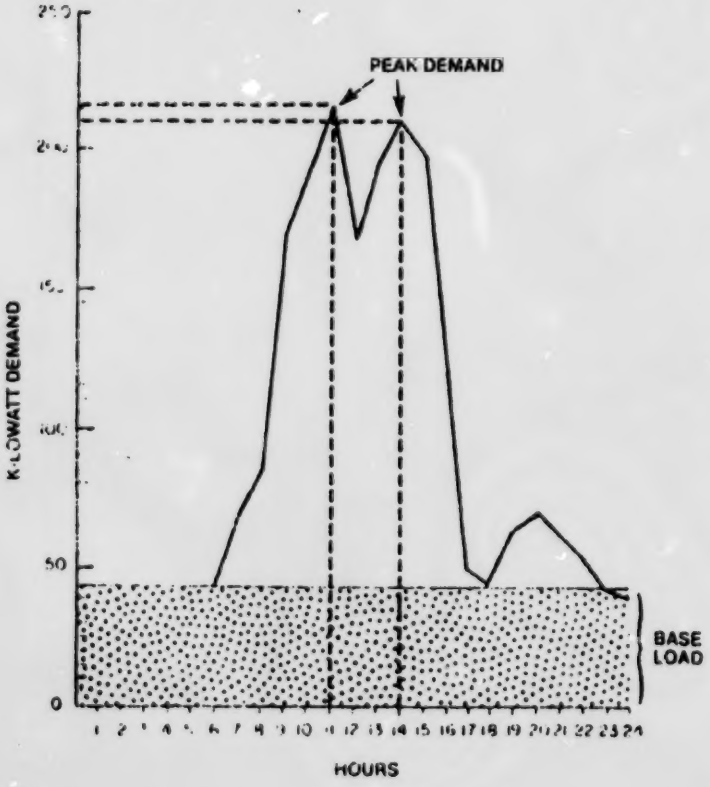


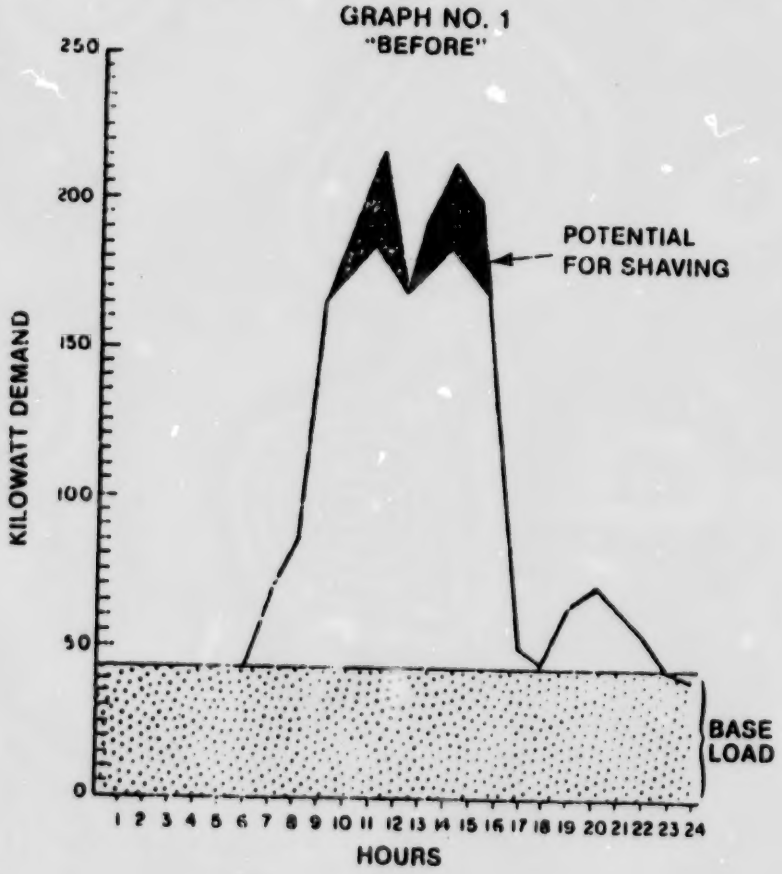
Figure 7

This is a typical daily load profile. The base load is comprised of all lighting, heating, ventilation, security lights, etc.. . ., operable 24 hours.

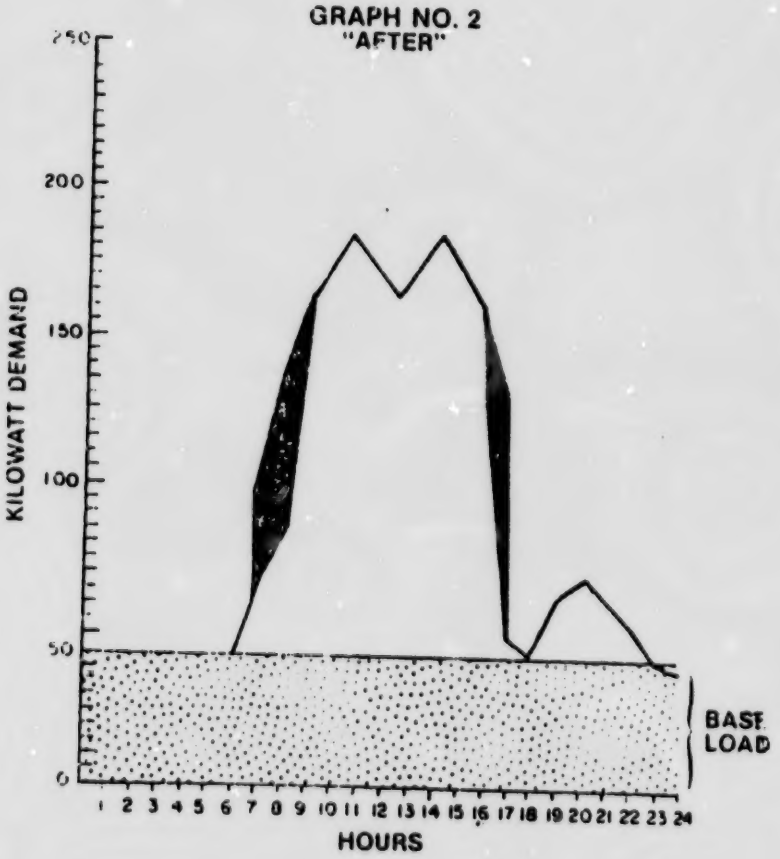
In this example, equipment begins operating at 6 a.m. More equipment continues to be turned on until at 11:00 a peak is reached. This peak falls off significantly at 12:00, during lunch hour. Equipment is turned on again after lunch till a second peak is reached at 2:00. At 4:00 (likely closing time), there is a significant reduction in the demand.

Savings can be achieved by shaving the peaks, as illustrated in Graph #1 as shown on the next page. Shaving means having a portion of the electrical load now operating at peak times shifted to non-peak times of the day — the total consumption would not be reduced. For example, instead of having 10 machines operating at 11:00, it would be advantageous to have 2 operating at 10:00, 6 at 11:00, and 2 at 1:00. All ten machines are still operating but not all at the same time. Graph #2 illustrates the daily load profile after the peaks have been shaved. The red area on Graph #1 is the peak area. In Graph #2 the peak has been shaved and relocated.

Savings



In Graph #1 the red area illustrates where savings are possible.



Graph #2 is the same example as Graph #1, but the peaks have been shaved.

Figure 8

From the typical daily load profile and equipment schedules, it is evident that demand charges could be "SHAVED".

.1 The lighting can only be marginally shedded, as this may cause major inconvenience, we do not recommend this.

.2 Ice refrigeration equipment can be possibly shedded. The large motors should not be cycled unduly, as life of equipment is a large factor.

.3 Pool equipment - some of the large exhause fans could possibly be cycled at peak periods. Approximate 20 KVA potential peak savings:
20 KVA x 12 months = 240 KVA

.4 Electric heating - the largest load (437 KW) can be cycled within tolerable comfort limits. We would estimate a possible savings of 200 KW would not be unreasonable, by simply cycling ½ the heaters on and the other ½ off.

Annual savings - 200 KW x 6 months = 1200 KVA

.5 Mechanical equipment - ie. exhaust fans:
Total connected actual demand load - approximately 30 KVA
Possible savings - 10 KVA x 12 months = 240 KVA

Total projected annual savings = 1680 KVA
(less refrigeration equipment) x $6.65
$11,172.00
$11,172.00 + 10% surcharge + 5% E&H Tax = $12,903.66

An approximate estimate for a load shedding system would be $32,000.00.

$$\text{Payback period} = \frac{\$32,000.00}{\$12,903.00} = 2.48 \text{ years}$$

It is recognized that the above calculations are dependant upon the comfort levels and equipment convenience which the users may find acceptable. Many factors including other projected mechanical revisions may affect the payback period.

DESCRIPTION OF ELECTRICAL SYSTEM

1. a) The power system consists of utility overhead high voltage lines in the North West corner, brought underground to a Saskatchewan Power Corporation oil filled padmount transformer, adjacent the building. Secondary underground 600/347 volt grounded WYE, conductors service the 1200 amp. main distribution board located in the North West corner of the complex. Saskatchewan Power energy consumption and peak volt-amp meter is connected on the secondary side of the main breaker. The main breaker has a shunt trip unit, connected to a ground fault sensor panel in the board.

   b) System Sub Feeders

   Refrigeration equipment: a 350 amp. breaker in the main CDP and a 3 conductor 300 MCM teck cable feeds the refrigeration equipment control panel. The refrigeration equipment is in the South East corner of the arena.

   Refrigeration equipment consists of the following 600 volt, 3 phase motors:

Condenser fan	- 15 horsepower
Condenser pump	- 3 horsepower
Curling brine pump	- 15 horsepower
Arena brine pump	- 20 horsepower
Curling heating pump	- 5 horsepower

Arena underfloor heating pump	- 5 horsepower
Refrigeration circulating pump	- 25 horsepower
Compressor	- 75 horsepower
Compressor	- 75 horsepower
TOTAL	243 horsepower

c) Panel 'AA' - 600/347 volt, 100 amp., 3 phase
- located in the main electrical room
- arena lighting is switched from breakers in this panel
- arena area power to fans circuited to breakers in this panel

Panel 'AB' - 600/347 volt, 175 amp., 3 phase
- located in the main electrical room
- circuits consist mainly of West dressing room electric heaters

Panel 'AC' - located in the North East arena dressing room area
- 600/347 volt, 175 amp., 3 phase
- circuits mainly East dressing room electric heaters

Panel 'CA' - located in the curling rink lounge room
- 600/347 volt, 150 amp., 3 phase
- curling rink lighting switched from breakers
- curling electric heaters - South wall
- electric heater - upper floor

Panel 'CB' - located in the upper concourse vent room
- 600/347 volt, 175 amp., 3 phase
- office air conditioning units (100 amp., 3 pole breaker)
- office vent units
- electric heaters to curling rink

Pool Panel - located in pool equipment room
- 600/347 volt, 100 amp., 3 phase
- pool equipment and heater

d) Secondary 120/208 volt Distribution No. 1:
A 200 amp., 3 pole breaker in the 600 volt main CDP feeds a 225 KVA dry type transformer located in the upper vent unit room. A 600 amp., 120/208 volt CDP board is located adjacent the transformer.

Panel 'AD' - 120/208 volt, 3 phase, 125 amp.
- located in West arena, main electrical room
- arena incandescent lights, receptables, power

Panel 'AE' - 120/298 volt, 3 phase, 150 amp.
- located in South West arena mechanical room
- arena incandescent lights, receptacles, power
- sub feeds - 100 amp. panel - power outlets in curling rink

Panel 'CC' - 120/208 volt, 3 phase, 125 amp.
- located in main office
- concourse lighting

Panel 'CD' - 120/208 volt, 3 phase, 125 amp.
- located in upper vent room
- upper concourse and curling lounge lighting

Panel 'CE' - 120/208 volt, 3 phase, 100 amp.
- located in upper vent room
- mechanical room heating and vent equipment
- duct heaters

Panel 'CF' - 120/208 volt, 3 phase, 125 amp.
- located in main office
- concourse and curling rink receptacles and power

Panel 'PA' - 120/208 volt, 3 phase, 100 amp.
- located in pool office
- pool lighting switched from breakers
- Pool/change area lighting, receptacles

Kitchen Panel - 120/208 volt, 3 phase, 200 amp.
- located in kitchen
- kitchen equipment

Sauna Heater - 208 volt, 3 phase, 70 amp. breaker

e) Secondary Distribution Unit No. 2:

Located in main electrical room.

A 150 amp., 3 pole breaker in the 600 volt main CDP feeds a - Delta - WYE dry type transformer. This feeds a 400 amp. splitter trough and a 120/208 volt panel. 15 car receptacles are circuited to this panel.

f) Summary of Electric Heaters:

Curling Rink	6 x 24 KW	= 150 KW
Entrances	2 x 30 KW	= 60 KW
West Arena Baseboard Heaters		= 47.5 KW
West F.F.		= 3 KW
EH 19		= 5 KW
East Arena Baseboard Heaters		= 50.5 KW
		366.5 KW
Pool Change Area Duct Heaters	4 x 7 KW	= 28 KW
Electric Whirlpool Heater		= 25 KW
		419.5 KW
15 Car Receptacles - 1200 W		= 18 KW
The Total Connected Electric Heating		=437.5 KW

Mechanical Equipment in Pool:

Circulating pump	5 horsepower
Air pump	3 horsepower
Pool circulating pump	7.5 horsepower
Supply air fan	15 horsepower
	30.5 horsepower

g) Summary of Connected Electrical Equipment:

		Diversified Load
Lighting	178,275 watts	152 KW
Ice Refrigeration Equipment	243 horsepower	varies
Pool Equipment	30.5 horsepower	20
Electric Heating	437.5 KW	varies
Mechanical Equipment - fans	(approx.) 45 horsepower	30
Mechanical Equipment-air conditioning	50 horsepower	25 h.p.

Total Connected Motor Loads: 368.5 horsepower

CURLING AREAS

	Incandescent 150 watts	Fluorescent 95 watts	Fluorescent 190 watts	Fluorescent 250 watts	Mercury 460 watts	Existing Light Level (LUX)	Recommended Level (LUX)
Curling Lobby		10				300	100 to 200
Curling Office	1	11	2				
Curling Ice Arena				96		440	500
Viewing	23	2				50 to 400	50 to 400
Washroom	2	4					
Bar	1	4					
Stair							
Eating	11	—	—	—		50 to 400	50 to 200
FIXTURES	38	31	2	96			
WATT SUB TOTAL	5700 watts	2945 watts	380 watts	24,000 watts			

TOTAL LIGHTING = 33,025 watts

CONFERENCE

	Incandescent 150 watts	Fluorescent 95 watts	Fluorescent 190 watts	Fluorescent 250 watts	Mercury 460 watts	Existing Light Level: (LUX)	Recommended Level: (LUX)
Kitchen	2	12				700 to 1000	750 to 1000
Washrooms		6					
Corridor		4					
Coats		3					
Conference	73	32				50 to 200	100 to 300
FIXTURES	75	57					
WATT SUB TOTAL	11,250 watts	5415 watts					

TOTAL LIGHTING = 16,665 watts

POOL

	Incandescent 150 watts	Fluorescent 95 watts	Fluorescent 190 watts	Fluorescent 250 watts	Mercury 460 watts	Existing Light Level: (LUX)	Recommended Level: (LUX)
Pool Area		14					
Machine Room	10				20	200 to 300	524
Change Room	4	18				400 to 700	160 to 200
Pool Lounge	15					150 to 1500	100 to 200
FIXTURES	29	32			20		
WATT SUB TOTAL	4350 watts	3040 watts			9200 watts		

TOTAL LIGHTING = 16,590 watts

h) Summary of Exiszing Lighting:

.1 AREA CHARTS

COMMON AREAS

	Incandescent 150 watts	Fluorescent 95 watts	Fluorescent 190 watts	Fluorescent 250 watts	Mercury 460 watts	Existing Light Level: (LUX)	Recommended Level (LUX)
Lobby	19	46				150 to 500	100 to 200
Entrance	3	6				150 to 1300	50 to 100
Canteen	1	10				900	750
Washrooms		5					
Office			23			900	750
Rink Entrance		6					
Stairs		2					
Curling Stair		3					
Arena Ramp		25					
Conference Stair		3					
Upper Office	19						
Upper Mechanical Room	11						
FIXTURES	53	106	23				
WATT SUB TOTAL	7950 watts	10,070 watts	4370 watts				

TOTAL LIGHTING = 22,390 watts

ARENA

	Incandescent 150 watts	Fluorescent 95 watts	Fluorescent 190 watts	Fluorescent 250 watts	Mercury 1100 watts	Existing Light Level: (LUX)	Recommended Level: (LUX)
Machine	6						
Corridor (W)	16	1				200 to 300	200 to 300
Storage	4						
Change Area (W)	5	26				50 200	50 100 to 200
Corridor (E)	16						
Zamboni	6					200 to 300	200 to 300
Change (E)	6	29					
Machine (E)	6	4				200	100 to 200
Ice Area			29		48	400 to 600	100 to 500
Seating (E)	18	3				50 to 200	depends on functior 50 to 200
Washrooms (E)		4					
Washrooms (W)		4				300 300	200 to 300 200 to 300
Seating (W)	18	8				50 to 200	50 to 200
FIXTURES	101	79	29		48		
WATT SUB TOTAL	15,150 watts	7505 watts	7250 watts		52,800 watts		

TOTAL LIGHTING = 82,705 watts

Total connected interior lighting = 171,375 watts.

Exterior lighting - 15 x 460 watts Mercury = 6900 watts.

Total interior and exterior connected lighting = 178,275 watts.

Exterior lighting:

6.9 KW x 9 hours x 365 days = 22666.5 KWH per annum x .0186 = 421.60 energy cost per year.

6.9 KW x $6.65 x 12 months = 550.62 demand charge.

Total annual exterior lighting billing costs = 927.21 + 10% surcharge + 5% E & H Tax.

Total exterior lighting cost $1,122.91 per annum.

1981 total consumption = 2,763,840 KWH x $.0186/KWH (1982 SPC rate) See table.

1981 energy = $51,407.42

1981 total demand = 6432 KVA x $6.65 = $42,772.80

Total = $94,180.22 + 10% surcharge + 5% E & H Tax.

Projected 1982 energy bill - $108,778.16 based upon 1981 consumption.

.2 ANNUAL INTERIOR LIGHTING

Convention centre annual hours usage
- 705 hours x 16665 watts = 11,748,825 WH

Curling rink annual hours usage
- 1684 hours x 33,025 watts = 55,614,100 WH

Ice arena annual hours wage
- 2390 hours x 82,705 watts = 197,664,950 WH

Aquatic pool annual hours wage
- 3816 hours x 16590 watts = 63,307,440 WH

Office and common area annual hours wage
- 3816 hours x 22,390 = 85,440,240 WH

Total watt hours = 413,775,560

.3 COSTS

Total billing = energy consumption + demand charge using the current 1982 SPC rates.

413,775 KWH x $.0186/KWH + 178,275 KW x 6.65 x 12 months. $7,696.23 + $14,226.34 =

$21,922.57 + 10% surcharge + 5% E & H Tax = $25,320.57

The total annual electrical lighting cost is $25,320.57.

$\frac{413,775 \text{ KWH}}{2,763,840 \text{ KWH}} = .149$ 15% of energy consumption in the complex is electric lighting.

$\frac{25,320.57}{108,778.16}$ = 23.3% of total electrical billing is due to lighting.

Annual electric heating and chilling electrical cost = 108,778.16 - 25,320.57 = $83,457.59.

Average cost of electricity = $\frac{\$108,778.16}{2,763,840 \text{ KWH}}$

= 3.935 ¢/KWH based upon 1982 rates and 1981 consumption,

i) Lighting Cost Comparioson:

A typical incandescent lamp produces approximately 15 lumens/watt. Installed in a fixture the total efficiency is in the order of 50%, therefore net lumen output is approximately 8 lumens/watt.

For a F40 CW fluorescent fixture, 2 lamps at 3150 lumens = 6300 lumens. Installed in a fixture the efficiency is approximately 40% = 6300 x .4= 2520 lumens - net output power is 95 watts, therefore $\frac{\text{net lumens}}{\text{watt}} = \frac{2520}{95 \text{ watts}}$

= 26.5 lumens/watt.

Comparing this to the incandescent fixture, it can be seen that fluorescent $\frac{26.5}{8}$=3.31 times more efficient.

A typical incandescent fixture is rated 150 watts, therefore producing 150 x 8 = 1200 lumens. Two incandescent fixtures would approximate one fluorescent fixture (in lumen output).

Therefore for replacement purposes, replacing two incandescent fixtures with one fluorescent will provide the equivalent light level. (average)

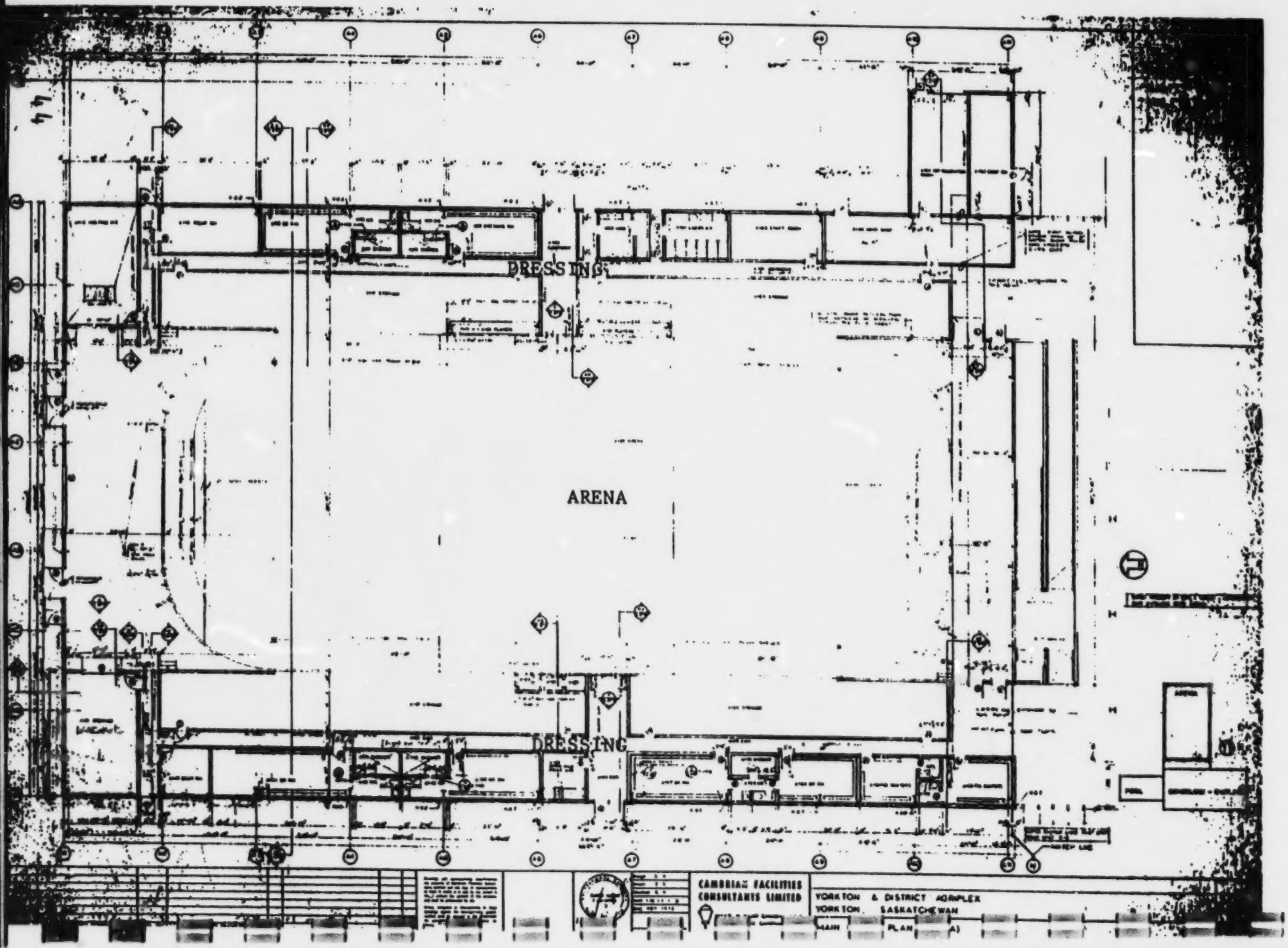
j) Light Switch Comparisons:

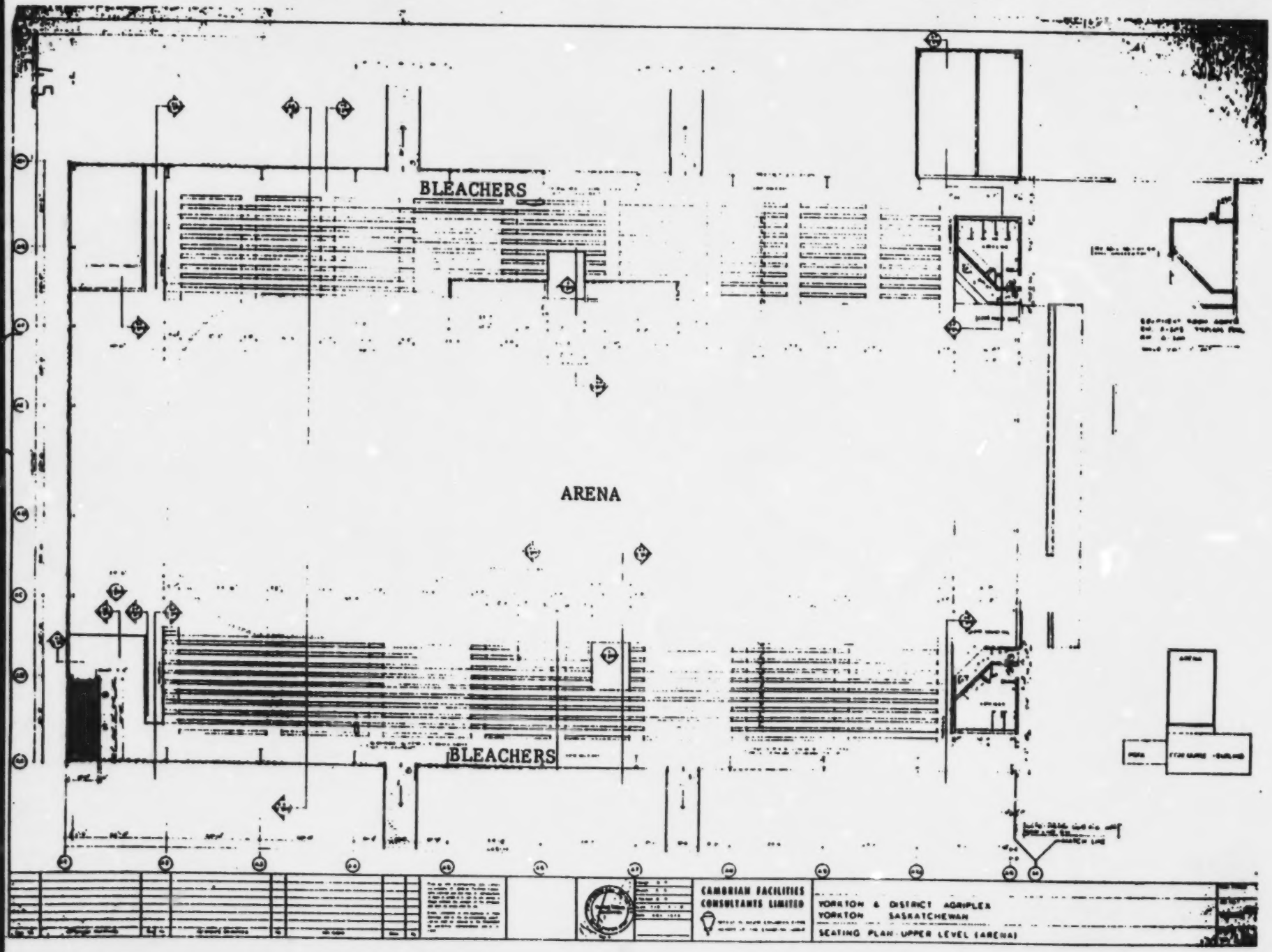
From the above calculations, we see the cost of energy for one fluorescent 4' x 2 lamp fixture is $10.26 per year. In small rooms or areas, if the fixture were shut off 1/3 of the time the cost savings would be $\frac{\$10.26}{3}$ = $3.42/year

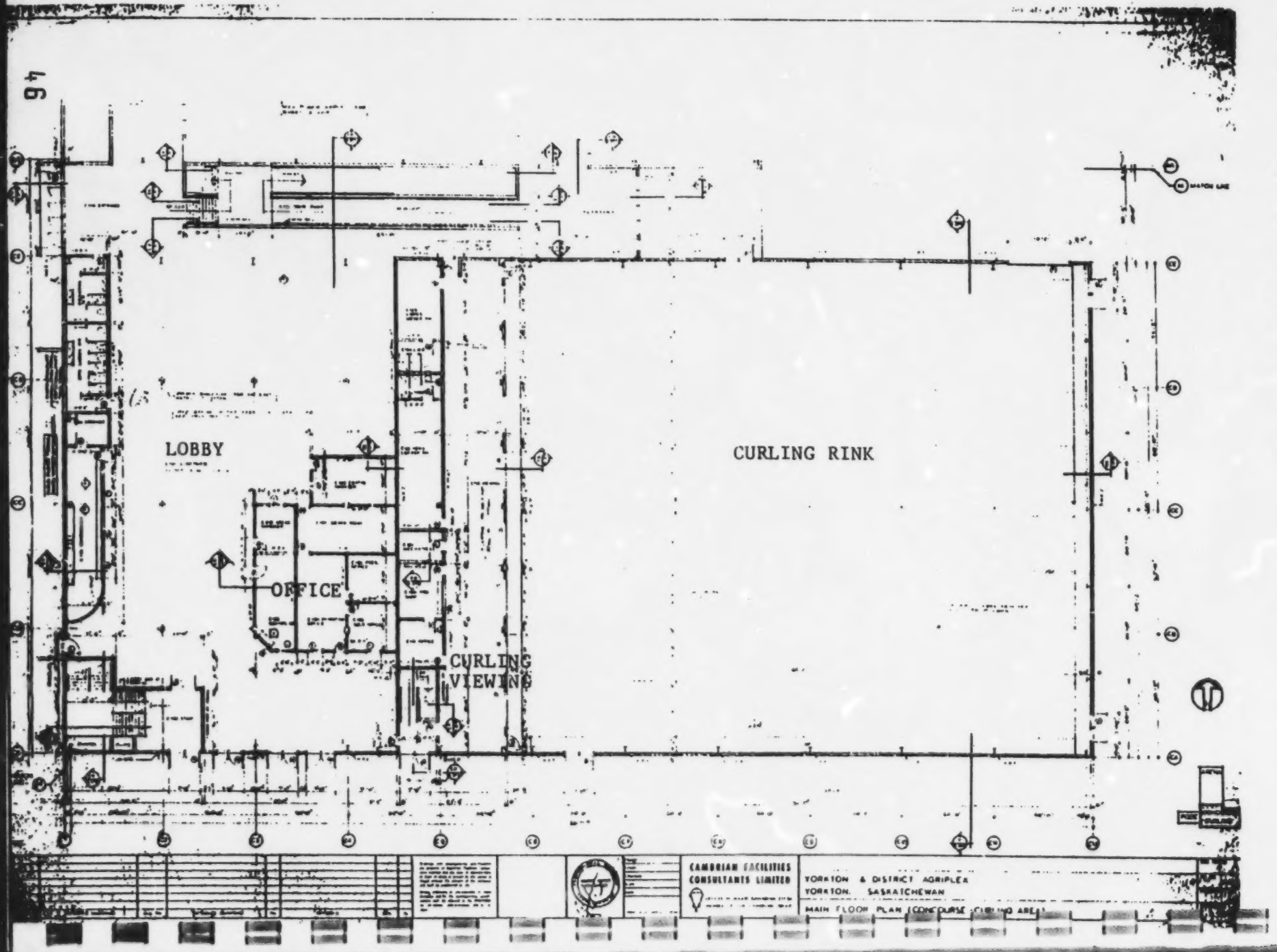
If we assume four fixtures in a typical room, the cost savings = $3.42 x 4 = $13.68/year. Cost of switch would be approximately $35.00, therefore the payback period is in the order of $\frac{\$35.00}{\$13.68}$ = 2.5 years.

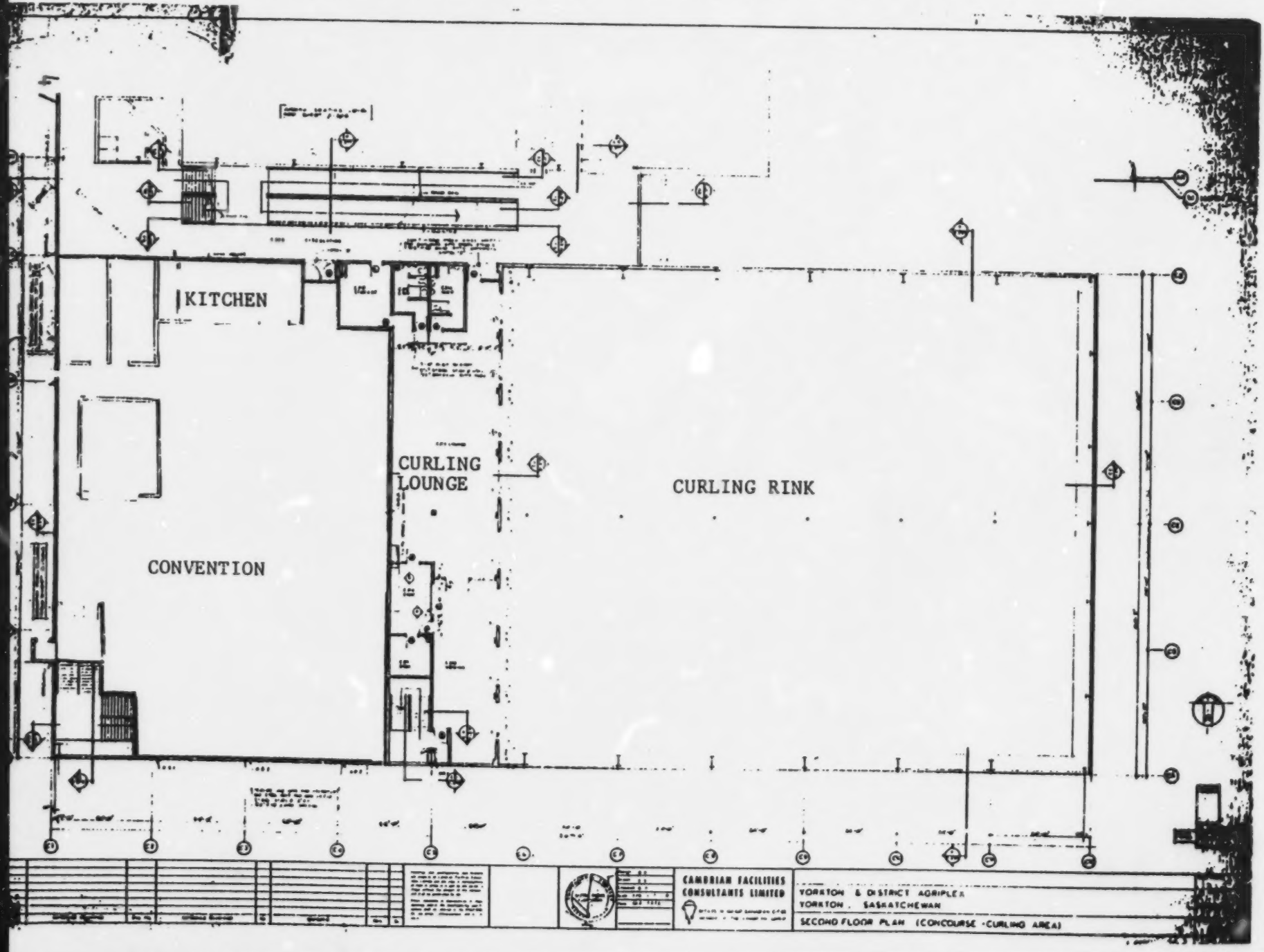
PARKLAND AGRIPLEX
ROOF PLAN

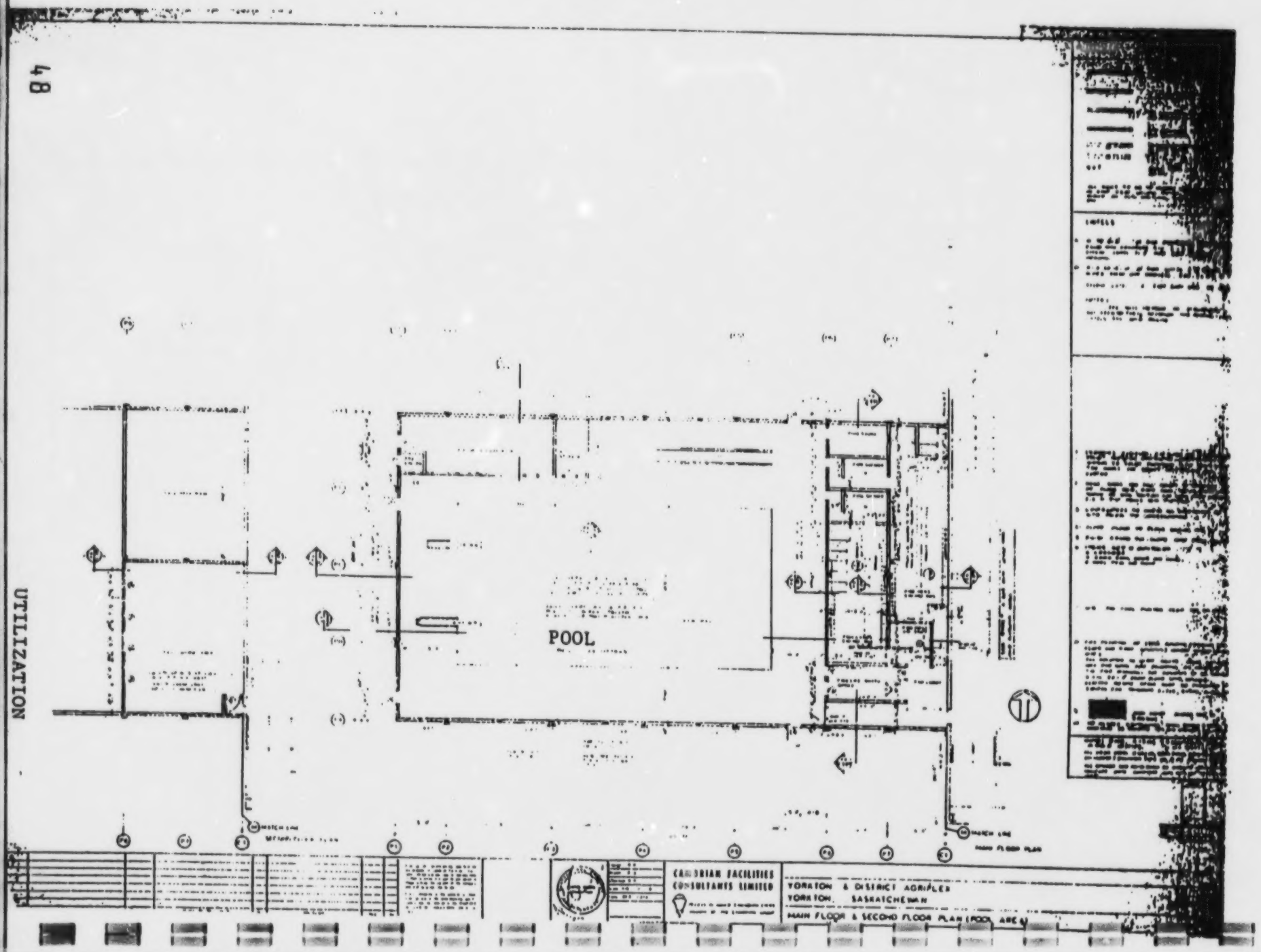
UTILIZATION


DRESSING
ARENA
DRESSING
CAMBRIAN FACILITIES CONSULTANTS LIMITED
YORKTON & DISTRICT AGRIPLEX
YORKTON SASKATCHEWAN
MAIN PLAN A1

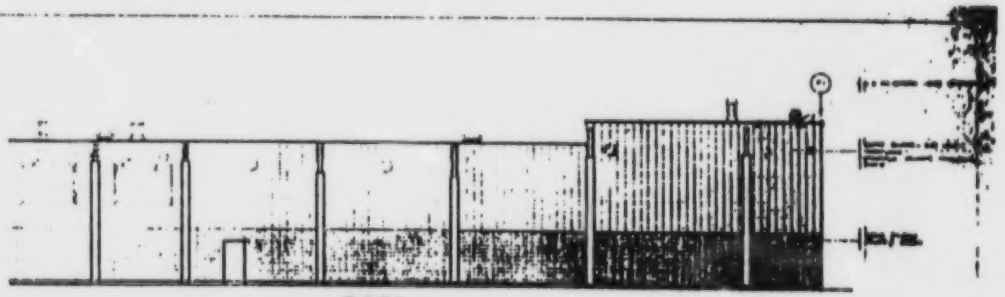

BLEACHERS
ARENA
BLEACHERS
CAMBRIAN FACILITIES CONSULTANTS LIMITED
YORKTON & DISTRICT AGRIPLEX
YORKTON SASKATCHEWAN
SEATING PLAN - UPPER LEVEL (ARENA)


LOBBY
OFFICE
CURLING VIEWING
CURLING RINK
CAMBRIAN FACILITIES CONSULTANTS LIMITED
YORKTON & DISTRICT AGRIPLEX
YORKTON, SASKATCHEWAN
MAIN FLOOR PLAN (CONCOURSE, CURLING AREA)


KITCHEN
CURLING LOUNGE
CURLING RINK
CONVENTION
CAMBRIAN FACILITIES CONSULTANTS LIMITED
YORKTON & DISTRICT AGRIPLEX
YORKTON, SASKATCHEWAN
SECOND FLOOR PLAN (CONCOURSE - CURLING AREA)

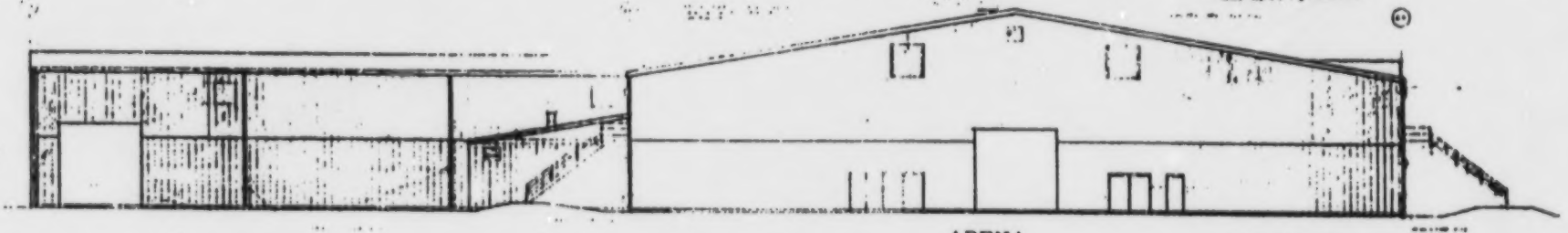


UTILIZATION



POOL

NORTH ELEVATION



ARENA

NORTH ELEVATION

ARENA

EAST ELEVATION

RINK

EAST ELEVATION

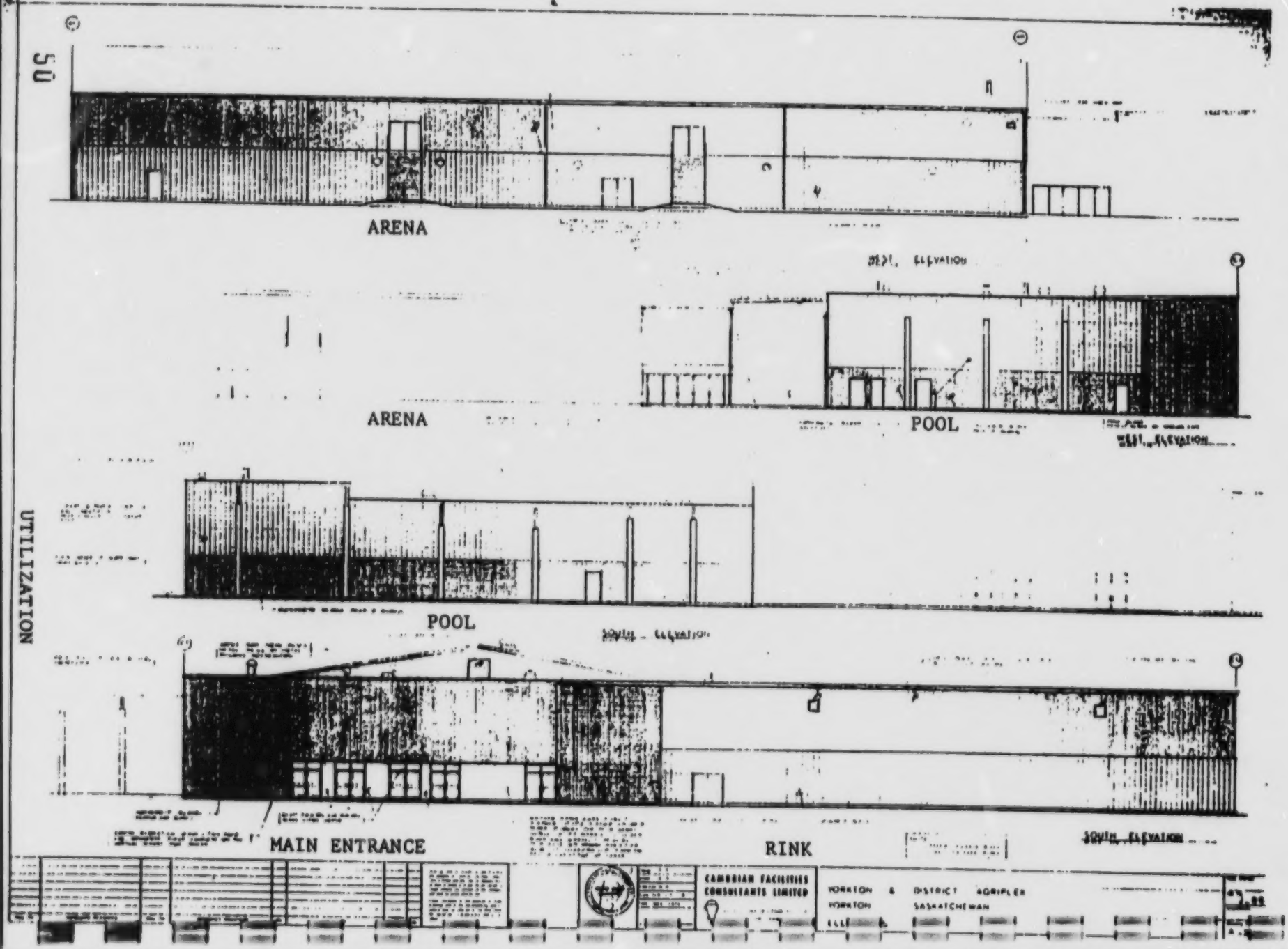
UTILIZATION

CAMBRIAN FACILITIES CONSULTANTS LIMITED

PORTION ... DISTRICT ... AGRIPLEX

PORTION ... SASKATCHEWAN

ELEVATIONS


ARENA
POOL
POOL
MAIN ENTRANCE
RINK
CANADIAN FACILITIES CONSULTANTS LIMITED
YORKTON & DISTRICT AGRIPLEX
YORKTON SASKATCHEWAN

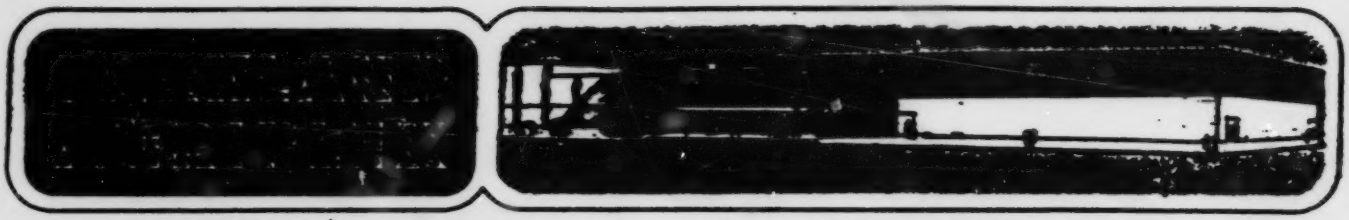
PARKLAND AGRIPLEX AQUATIC CENTRE

Summary of Average Annual Utilization
(hours per month)

	J	F	M	A	M	J	J	A	S	O	N	D
All Activities	296	296	296	340	340	340	316	316	316	320	320	320

Summary of Average Annual Utilization
(patrons per month)

	J	F	M	A	M	J	J	A	S	O	N	D
Patrons	4800	4800	4800	6100	6100	6100	4500	4500	4500	5500	5500	5500



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PARKLAND AGRIPLEX AQUATIC CENTRE

SEASONAL STATISTICS:

Programmes: (Based on weekly average)	JAN-MAR	APR-JUNE	JULY-AUG	OCT-DEC
School Classes	9 hours	9 hours	-	9 hours
Rentals	6 hours	15 hours	8 hours	6 hours
Regular Classes	18 hours	20 hours	21 hours	20 hours
Competitions	3 hours	3 hours	-	9 hours
Restricted Swims (ie-Adult)	11 hours	11 hours	11 hours	11 hours
Special Programmes	12 hours	12 hours	8 hours	10 hours
Public Swimming	15 hours	15 hours	34 hours	15 hours
Weekly average	74 hours	85 hours	79 hours	80 hours
Patrons p/month	4,800	6,100	4,500	5,500

I hope this assists you.

Respectfully Submitted,

Phillip Fournier,
Manager
AQUATIC CENTRE

PARKLAND AGRIPLEX ICE ARENA

Summary of Average Annual Utilization

(hours per month)

1981 Schedule

	J	F	M	A	M	J	J	A	S	O	N	D
All Events	343	321	303	56		Approx. 260 hours			144	322	328	313
	Winter Season				Summer Season				Winter Season			

JANUARY, 1981 ARENA REPORT

Total Hours Used

Yorkton Figure Skating Club	147.50
Yorkton Minor Sports Association	94.50
Men's Recreational Hockey	24.75
Yorkton Terrier Old Timers	2.00
Public Skating	6.00
Yorkton Schools	13.25
Yorkton Terriers - Practice	22.50
- Games	18.00
Miscellaneous	12.50

The total number of hours of ice time for the Arena for the month of January was 341 hours.

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FEBRUARY, 1981 ARENA REPORT

Total Hours Used

Yorkton Figure Skating Club	124.50
Yorkton Minor Sports Association	96.50
Men's Recreational Hockey	26.25
Yorkton Terrier Old Timers	3.00
Public Skating	6.00
Yorkton Schools	11.00
Yorkton Terriers - Practice	24.00
- Games	18.00
Miscellaneous	10.50

The toal number of hours of ice time for the Arena for the month of February was 317.75 hours.

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MARCH, 1981 ARENA REPORT

Total Hours Used

Yorkton Figure Skating Club	120.50
Yorkton Minor Sports Association	89.50
Men's Recreational Hockey	4.50
Yorkton Schools	4.00
Yorkton Terriers - Practice	7.50
- Games	6.00
Perogie Cup	28.50
Yorkton Friendship Tournament	34.00
Miscellaneous	6.00

The total number of hours of ice time for the Arena for the month of March was 300.50 hours.

APRIL, 1981 ARENA REPORT

Yorkton Minor Sports	49.50
Yorkton Schools	6.00
Legion Track and Field	5 Days

PARKLAND AGRIPLEX

ARENA

SUMMER UTILIZATION

April 15 to August 15

- rink used only when needed - example:

Horse Show - 2 days
Rock Concerts - 2 days
Fair - 4 days
Farm & Leisure - 4 days
Dog Show - 3 days
Track and Field - 3 days
Dances - 2 days
Mine Demonstration - 5 days
Circus - 1 day

PARKLAND AGRIPLEX

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SEPTEMBER, 1981 ARENA REPORT

Minor Sports	23.00 hours
Figure Skating	58.00 hours
Recreational Hockey	1.50 hours
Miscellaneous	7.00 hours
Terrier Practice	12.00 hours
Terrier Training Camp	30.00 hours
Terrier Games - 3 Exhibition	9.00 hours
Terrier Inter-Squad Game	3.00 hours

The total number of hours of ice time for the Arena for the month of September was 143.50 hours.

PARKLAND AGRIPLEX

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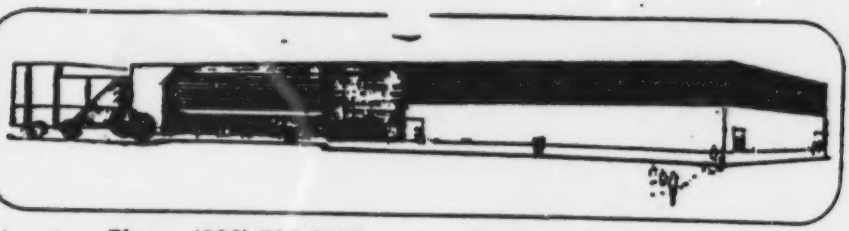
OCTOBER, 1981 ARENA REPORT

Figure Skating	144.00 hours
Minor Sports	112.75 hours
Terrier Old Timers	4.00 hours
Recreational Hockey	15.25 hours
Private Ice Rental	4.50 hours
Terrier - Practice	22.50 hours
- Games (6)	18.00 hours

The total number of hours of ice time for the Arena for the month of October was 321 hours.

PARKLAND AGRIPLEX



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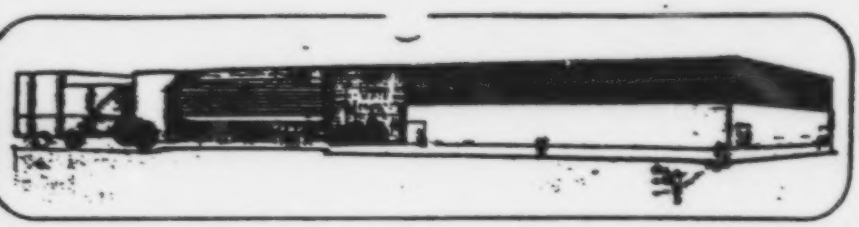
NOVEMBER, 1981 ARENA REPORT

Figure Skating	126.50 hours
Minor Sports	104.5 hours
Terrier Old Timers	4.00 hours
Recreational Hockey	27.50 hours
Private Ice Rental	8.50 hours
Yorkton Schools	4.00 hours
Commercial Hockey	8.00 hours
Terriers - Practice	21.50 hours
- Games (7)	21.00 hours

The total number of hours of ice time for the Arena for the month of November was 325.50 hours.

PARKLAND AGRIPLEX



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DECEMBER, 1981 ARENA REPORT

Minor Sports	73.75 hours
Minor Sports - Tournaments	74.00 hours
Figure Skating	92.25 hours
Recreational Hockey	14.00 hours
Private Ice Time	11.00 hours
Yorkton Schools	7.00 hours
Public Skating	7.00 hours
Yorkton Terriers - Practice	17.5 hours
- Games (4)	12.00 hours
Terrier Old Timers	3.00 hours
Commercial Hockey	1.00 hour

The total number of hours of ice time for the Arena for the month of December was 312.5 hours.

PARKLAND AGRIPLEX CURLING RINK

Summary of Average Annual Utilization
(hours per month)

	J	F	M	A	M	J	J	A	S	O	N	D
All Activities	236	236	236	118		Approx. 150 Hours				236	236	236
	Winter Schedule				Summer Schedule					Winter Schedule		

PARKLAND AGRIPLEX

CURLING RINK

UTILIZATION

January 1 to April 15
and
October 1 to December 31

- open as scheduled
- weekdays - average - 7 hours per day
- weekends - average - 12 hours per day.

April 15 to October 1
- rink open only when needed
  example:
  Dances - 5 days
  Farm & Leisure - 4 days
  Fair - 4 days
  Octoberfest - 3 days

PARKLAND AGRIPLEX CONVENTION CENTRE

Summary of Average Annual Utilization

(hours per month)

1982 Schedule

	J	F	M	A	M	J	J	A	S	O	N	D
All Activities	95	65	85	93	79	53	64	36	24	27	35	49

PARKLAND AGRIPLEX

CONCESSION

UTILIZATION

January 1 to May 15

Weekdays - 5:00 p.m. - 11:00 p.m.

Weekends - 8:00 a.m. - 11:00 p.m.

May 16 to August 15

Open only when needed

August 16 to December 31

Weekdays - 5:00 p.m. - 11:00 p.m.

Weekends - 8:00 p.m. - 11:00 p.m.

AGRIPLEX SCHEDULES - 1981 - 1982

CONVENTION CENTRE

January, 1982

Bingos	40 hours
Banquets	49 hours
Blue Line Club	6 hours

February, 1982

Bingos	12 hours
Meetings	6 hours
Blue Line Club	6 hours
Banquets	18 hours
Dances	7 hours
Conventions	2 days

March, 1982

Meetings	27 hours
Bingos	12 hours
Dances	28 hours
Banquets	15 hours
Blue Line Club	3 hours

April, 1982

Blue Line Club	3 hours
Dances	14 hours
Wedding	7 hours
Meetings	9 hours
Bingos	4 hours
Farm Fair	4 days
Conventions	3 days

May, 1982

Banquets	6 hours
Bingos	12 hours
Conventions	5 days
Dances	14 hours
Wedding	7 hours

June, 1982

Banquets	30 hours
Bingos	16 hours
Wedding	7 hours

July, 1982

Banquet	4 hours
Wedding	28 hours
Fair	4 days

August, 1982

Weddings	21 hours
Anniversary	7 hours
Banquet	4 hours
Meeting	4 hours

September, 1982

Weddings	21 hours
Banquets	6 hours

November, 1982

Banquets & Dances	35 hours

December, 1982

Banquets & Dances	49 hours

Average Duration of Events:

1 Bingo lasts 4 hours
1 Dance lasts 7 hours
1 Banquet lasts 3 hours
1 Meeting lasts 3 hours
1 Banquet and Dance lasts 7 hours
1 Wedding or Anniversary lasts 7 hours.

ENERGY CONSUMPTION

YORKTON PARKLAND AGRIPLEX

PARKLAND AGRIPLEX

ELECTRICAL AND NATURAL GAS CONSUMPTION

SERVICE TO	1980 ELECTRICAL			1980 NATURAL GAS		1980
	CONSUMPTION	DEMAND	COST	CONSUMPTION	COST	MONTHLY BILL
ANUARY	484800	768.0 KVA	12,862.08	28527	4969.19	17,831.27
EBRUARY	378240	806.4 KVA	11,243.79	24149	4249.72	15,493.51
ARCH	459840	768.0 KVA	13,109.34	30090	5451.90	18,561.24
PRIL	375360	768.0 KVA	11,450.58	20022	3629.59	15,080.17
AY	69120	288.0 KVA	2,887.31	5105	929.62	3,816.93
UNE	67200	288.0 KVA	2,849.62	6629	1205.46	4,055.08
ULY	73920	192.0 KVA	2,471.51	4794	873.32	3,344.83
UGUST	50880	192.0 KVA	2,019.13	3381	617.57	2,636.70
EPTEMBER	141120	403.2 KVA	4,913.10	5890	1098.21	6,011.31
CTOBER	207360	518.4 KVA	6,825.78	7093	1417.12	8,242.90
OVEMBER	406080	663.6 KVA	11,339.70	13928	2879.86	14,219.56
ECEMBER	356160	768.0 KVA	11,073.58	25549	5851.50	16,925.08
OTALS	3,070,080 KWH	6423.60 KVA	$93,045.52	175,157ccf	$33,173.06	$126,218.78

PARKLAND AGRIPLEX

ELECTRICAL AND NATURAL GAS CONSUMPTION

SERVICE TO	1981 ELECTRICAL			1981 NATURAL GAS		1981
	CONSUMPTION	DEMAND	COST	CONSUMPTION	COST	MONTHLY BILL
ANUARY	478080	768.0 KVA	13,467.49	32983	7552.54	21,020.03
EBRUARY	289920	768.0 KVA	10,050.16	19009	4355.12	14,405.28
ARCH	380160	787.2 KVA	12,783.35	)	)	)
PRIL	293760	652.8 KVA	10,178.78	)	)	)
AY	144000	537.6 KVA	6,459.87	)106983*	)$25675.99	)$61599.99
UNE	79680	249.6 KVA	3,251.00	)	)	) or 12320 /mo
ULY	79680	249.6 KVA	3,251.00	)	)	)
UGUST	50880	249.6 KVA	2,685.51	7503	1947.12	4,632.63
EPTEMBER	108480	364.8 KVA	4,594.86	3673	956.08	5,550.94
CTOBER	180480	499.2 KVA	6,916.70	6421	1667.08	8,583.78
OVEMBER	325440	614.4 KVA	10,541.36	13290	3444.42	13,985.78
ECEMBER	353280	691.2 KVA	11,606.92	19437	5034.94	16,641.86
OTALS	2,763,840kw	6432.0 KVA	$95,787.00	209 299 ccf	50,633.29	$146,420.29

* 106 983 ccf assumed by SPC based on average cosz of $.240/ccf for this period while meter was faulty.

CODES

We have visited the facility and have the following ovservations to make with respect to Codes and Regulations.

FIRE SAFETY

It would appear that there are a few problems relating to compliance with the fire code, i.e. the railings along the ramps are not in accordance with the Code; the dog-back devices exist on fire exits; and the lay-in ceiling tile does not appear to be clipped down to provide the required floor to floor rating.

It would take a considerable time and effort to do a thorough assessment of the facility with respect to compliance with Fire Code requirements and we feel this is not a main requisite of this study.

HANDICAP ACCESS

Other than compliance with current hardware and bathroom sizes and lay-outs, the facility is designed to provide full ccess for the handicapped.

A. ARCHITECTURAL

POOL

NO COST

1. In reviewing the building envelope and the present condition of weatherstripping at doors and windows, we noted that there are a number of doors with ill fitting or worn weatherstripping. The review of the Thermo Scan photographs clearly shows the leakage around the various exterior door frames (see photographs 10, 14, 16, 17 and 26).

   Although no cost can be clearly identified in energy costs lost through these gaps, it would seem that indeed a considerable energy loss occurs.

   We therefore recommend that under the normal maintenance program all weatherstripping and sweeps are closely checked and replaced or adjusted.

2. Photographs no. 13, 14, 15, 18 and 19 of the attached thermal scan show a lot of exfiltration at the areas where the glue laminated beams go through the wall and connect to the exterior concrete block columns. The natural shrinkage of the wood and the continuous movement of the warm beam in relation to the fluctuating wall requires the installation of a good seal at this area. We suggest that a sealant bead be applied as shown on detail (A) (attached).

We would further point out that this system of connecting from interior warm to exterior fluctuating has some undesirable effects which are evident at the tops of the exterior columns. Since, however, this is a structural matter and outside the scope of this report, we cannot go into greater detail except to identify this potential problem area (see attached photographs).

3. With the installation of a night set back thermostat a large amount of cooling will take place in the pool water. In order to preserve this heat, we suggest that a thermal pool blanket be installed on the pool during periods of non-use. The cost of this blanket and the rollers should not exceed $3,000. We have been unable to calculate an energy saving for this measure and thus cannot identify a payback period for this item.

4. Although it is not possible to identify clearly a payback time based on energy saved, it is however quite evident that by upgrading the hollow metal door that leads to the exterior from the pool equipment area would result in an energy saving. The appended thermal scan information (see photo #17) clearly shows an extraordinary heat loss through this door. We suggest that the replacement should have an insulated core. The cost of this replacement should not exceed $300.

5. In a high humidity area such as pools, it is imperative that a good vapour barrier is applied to the interior of the building envelope. This is even more important where the envelope is a single wythe concrete block wall with a vermiculite loose fill insulation. As can be seen on photo #14 of the thermal scan some moisture-laden areas are evident in the wall, reducing the R-value of the insulation. This moisture is a condensation of exfiltrated humid air from the pool area.

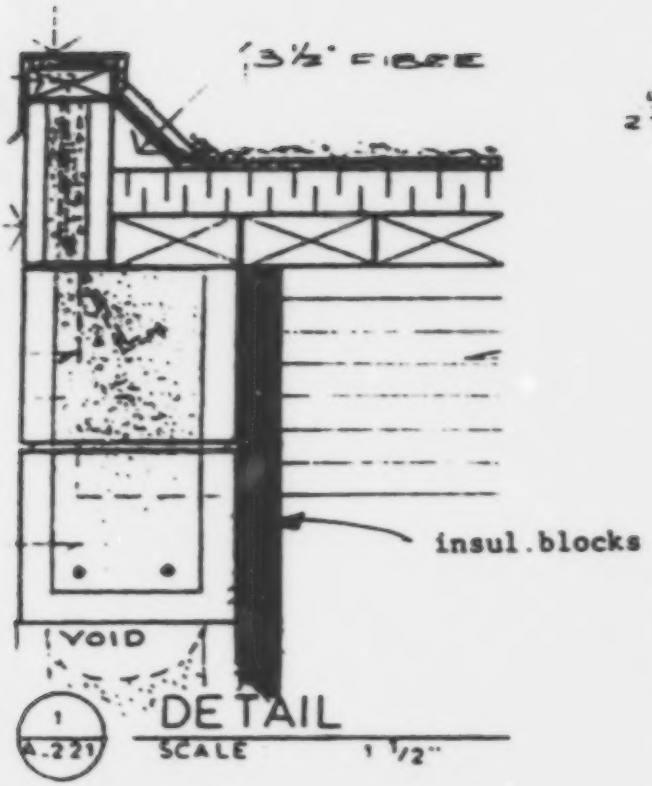
   We suggest therefore that one additional coat of oil base paint be applied to the walls to ensure a reasonable vapor barrier on the interior skin. (See attached drawing showing detail). Since the deterioration is spotty, it is quite difficult to determine any payback time.

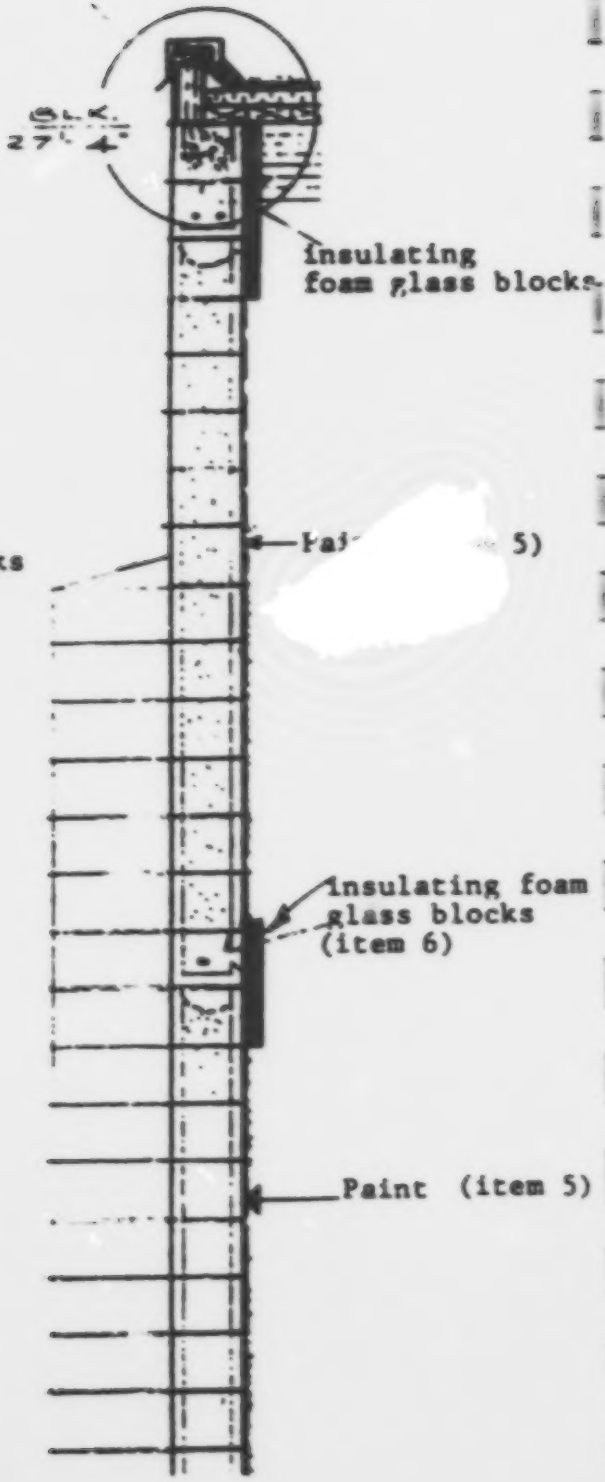
6. The thermal scan (photos 13, 14, 15, 16, 17, 18 and 19) show direct thermal conductivity at the intermediate vertical and horizontal bond beams. These areas are concrete-filled concrete block with no effective R-value.

We suggest that these bond beams be insulated on the interior of the building with the application of 12" x 12" x 2" foamed glass squares glued on to the masonry. We would further suggest that the blocks be extended to one row below the actual beam depth since it seems evident that the vermiculite loose fill insulation has settled.
(See attached details)

Because the application is to the interior and because of possible vandalism at a lower level, we suggest terminating the work at a point 7'-4" above finished floor. The total cost for this work should not exceed $7,000.

Payback period would be 4.5 years, based on a yearly saving of MCF 474.

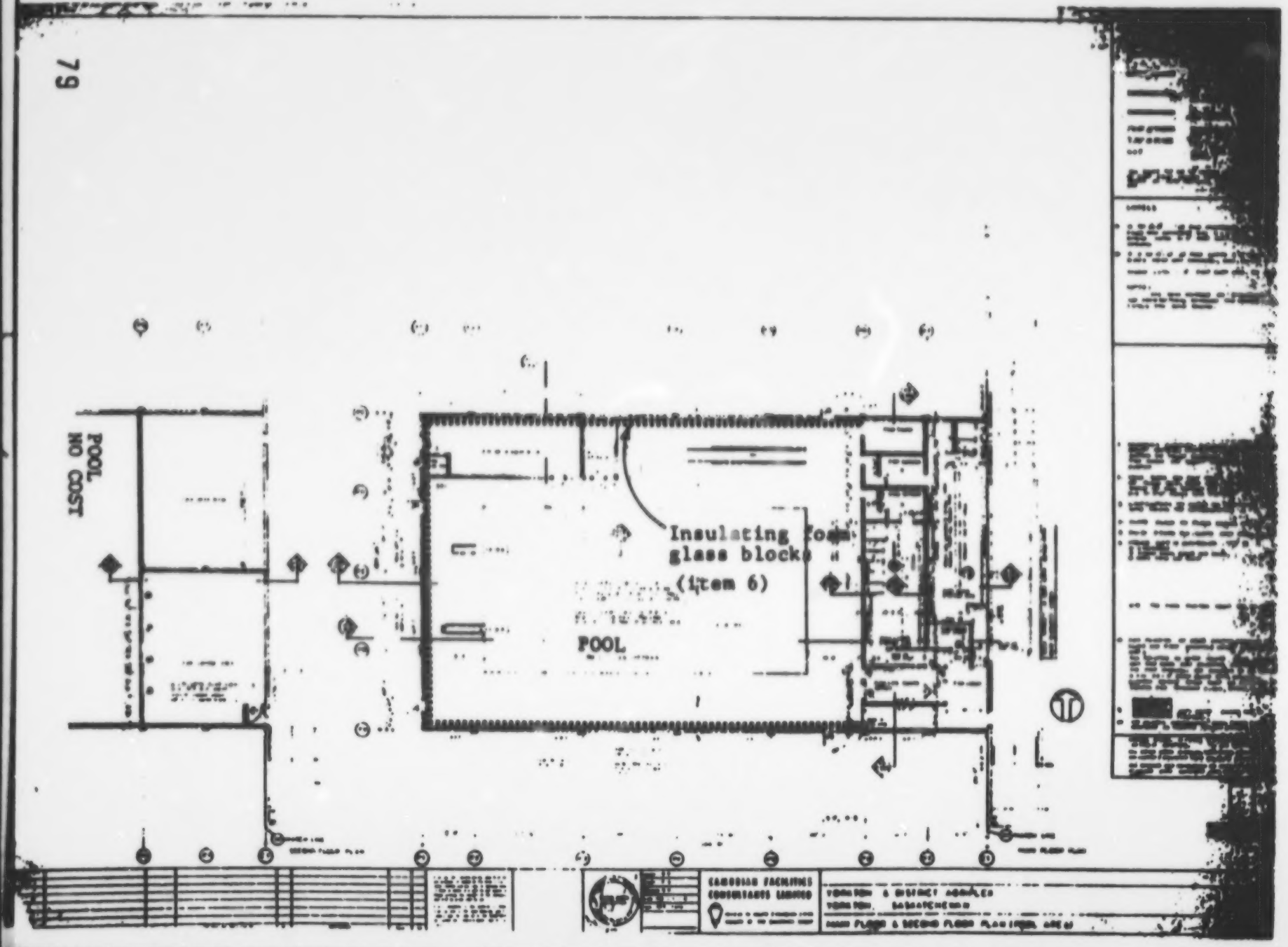


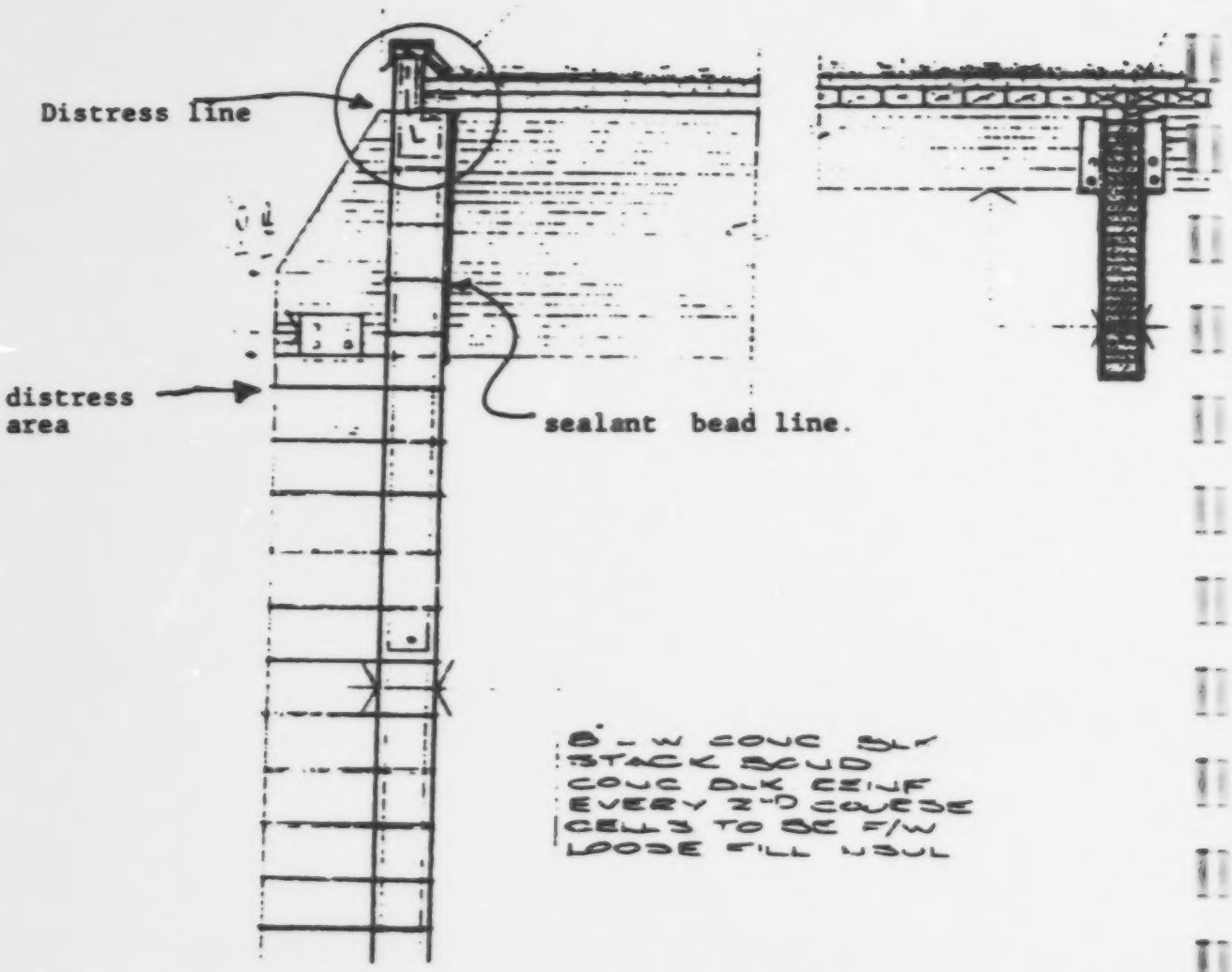


PARKLAND AGRIPLEX

POOL

NO COST - items 5 & 6


POOL
NO COST
Insulating foam
glass blocks
(item 6)
POOL


Distress line
distress area
sealant bead line.
8"-W CONC BLK STACK BOND CONC BLK REINF EVERY 2ND COURSE CELLS TO BE F/W LOOSE FILL INSUL

PARKLAND AGRIPLEX

POOL

NO COST - detail A
item 2

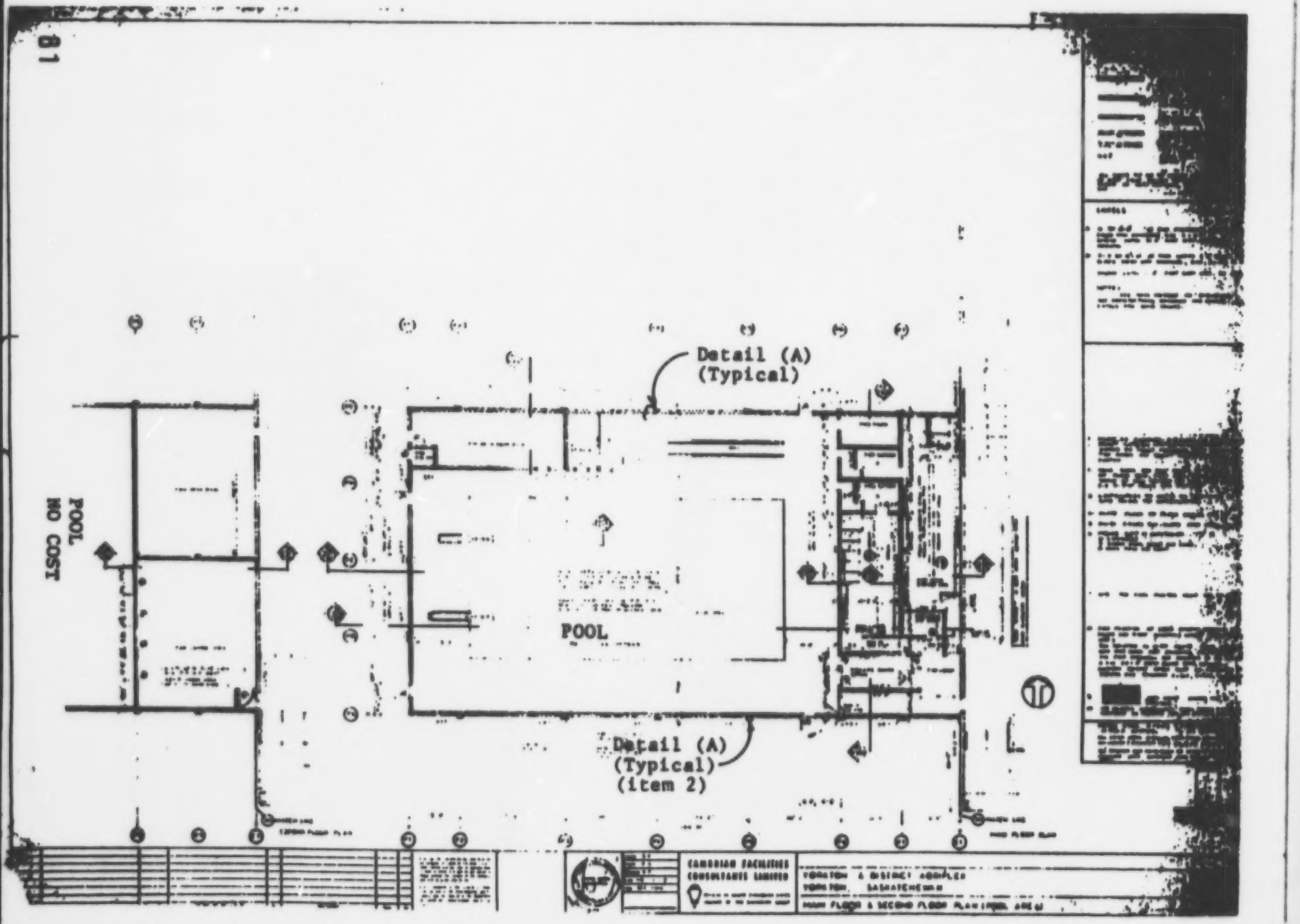

Detail (A)
(Typical)
POOL
NO COST
POOL
Detail (A)
(Typical)
(item 2)

Photo showing stress on top layer of block.

Photo showing stress on block pillars.

Photo showing stress on top layer of block.

PARKLAND AGRIPLEX POOL

No Cost

B. MECHANICAL

POOL

NO COST

1. Showerhead Flow Restrictors:

If not already done, we would suggest the installation of flow restrictors in all shower heads.

Although this change does not reduce the percentage of hot water mixed in it does reduce the amount of hot water used on a time basis.

The cost of a flow restrictor, supplied and installed, would be approximately $20 per shower head. We would suggest using a 2 GPM flow restrictor reducing the shower output from 5 GPM to 3 GPM.

With natural gas at $3.00/mcf and the water heater efficiency assumed to be 75% the cost of heating a gallon of water from 50°F to 110°F is 0.225¢. The simple payback period for this installation would be approximately 70 hours of operation.

2. Pool Equipment Operation:

At present the pool pump and the whirlpool filter pump run continuously. In order to reduce the electrical costs and also the amount of heat and evaporation lost to the air above the water surface, we would suggest the addition of a time clock to control the pump operation.

The cost of a time clock installed would be approximately $250 and with the cost of electrical energy at approximately 4.0¢/kWh the simple payback time would be 70 days assuming the pumps can be shut down 10 hours a day. We have not taken into consideration the energy saved by the reduction in heat loss and evaporation that will occur if the pumps are shut down.

3. Washroom Exhaust System:

At present the washroom exhaust fan in the pool area runs continuously. The fan is sized at 2,400 cfm and the replacement air is supplied by a direct fired make-up air unit that also runs continuously supplying 4,300 cfm to this area as well as supply air to the upper and lower concourse area.

We would suggest the installation of a time clock, a 2-speed fan motor on the make-up air unit, and a damper in the supply air duct to the washroom area.

The exhaust fan would run only during occupied times and when not operating the supply air unit would operate on low speed and the damper in the supply air ductwork to the washroom area would close.

The cost of the time clock, the 2-speed fan motor, and the damper, supplied and installed, would be approximately $1,200.00.

With natural gas at $3.00/mcf the cost to supply one C.F.M. of outside air at 70°F minimum is approximately $1/year. (See Appendix A)

If the 2,400 cfm exhaust fan was to operate 50% of the time a $1,200/year savings per year would be realized giving a one year payback period.

4. Antistratification Fans:

In order to reduce the temperature difference of the air between the ceiling of the pool enclosure and the floor or pool deck we would propose the addition of six (6) antistratification fans in the area. It is important that these units be properly located and be complete with a variable speed controller, as drafty conditions cannot be tolerated in the occupied areas.

The cost of the fans that we are proposing would be approximately $2,400.00 installed. In a typical installation the payback period has been approximately 2 years. However, due to the type of ventilation system presently installed, we would estimate a realistic payback period of approximately 4 years.

See attached information on type of fan proposed.

5. Area Temperature and Humidity Control:

The existing thermostat and humidistat have no apparent effect on the temperature and humidity in the space.

We would propose the addition of a time clock and proper controls located in the space. The time clock would allow the temperature and humidity in the area to change during off hours operation. The fans (supply and exhaust) may be cycled during certain times and the return air portion of the ventilation system would be tied into the control sequence.

The cost of this proposal would be approximately $1,500 to $2,000 and although we cannot accurately establish a payback period we would estimate one of less than one year. This item would be even more effective if the proposed pool cover is introduced.

6. Domestic Hot Water:

The domestic hot water being used in the pool area for showers, etc., is being heated by means of a natural gas fired water heater located in a room adjacent to the artificial ice plant equipment room.

We would suggest that domestic water being used in this area of the building, as well as the domestic water being used in the remainder of the building, be heated by waste heat recovered from the ice plant chillers.

The cost of the required heat exchangers is discussed in the arena portion of this report, however, the piping changes required to tie the pool area domestic hot water system into the waste heat recovery system would be approximately $2,000.00.

With natural gas at $3.00/mcf and the existing water heater at 75% efficiency it presently costs approximately 0.225¢/gallon to heat domestic water from 50°F to 110°F.

With ten (10) shower heads operating at 5 gpm the simple payback would be approximately 260 hours of operation.

It is important to note that the domestic water being supplied to washrooms and showers throughout the complex will not be tied into the proposed water treatment plant. The cost of using de-ionized water other than as pool make-up water and ice making is not justified.

7. Whirlpool Heating:

The existing whirlpool is presently heated with an electric water heater, 37 kW/600V.

In order to reduce energy costs, we propose changing the electric unit to a gas fired heater.

The new gas fired unit would cost $1,000 installed and would be approximately 50% less expensive to operate.

At full load operation and with electrical energy at 4¢/kWh the existing heater costs $1.50/hour to operate.

With natural gas at $3.00/mcf and assuming 75% heater efficiency the proposed unit will cost 75¢/hour to operate, a savings of 75¢/hour as compared to the electric unit.

At 75¢/hour saving the simple payback would be 1,333 hours of full load operation.

8. Dampers:

At present the supply and exhaust air fans run continuously, however, if a pool cover is introduced and additional pool wall and roof area insulation is applied, it will be possible to cycle the supply and exhaust air fans. When the fans are shut down air leakage through the existing backdraft dampers may be a problem with a 6% leakage factor not being uncommon.

We would suggest the addition of a 100% shut off damper system on both the supply and exhaust openings through the building wall.

The type of damper recommended is a "MITCO" Type as per the information sheet attached.

The total damper package installed on the pool area ventilation system would be approximately $6,000.00. The energy saved by this addition, assuming that the exhaust fans would run 50% of the time, would be approximately $500/year. This figure was arrived at using 6% damper leakage and $3.00/mcf gas cost.

The simple payback for this installation would be 12 years.

PARKLAND AGRIPLEX
POOL

NO COST
(Mechancial Item 4)

A fan for all reasons

industrial • commercial • reside
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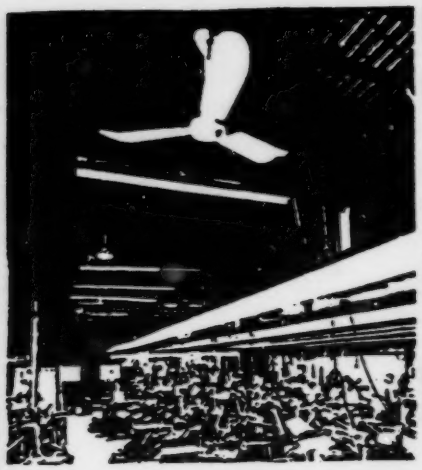
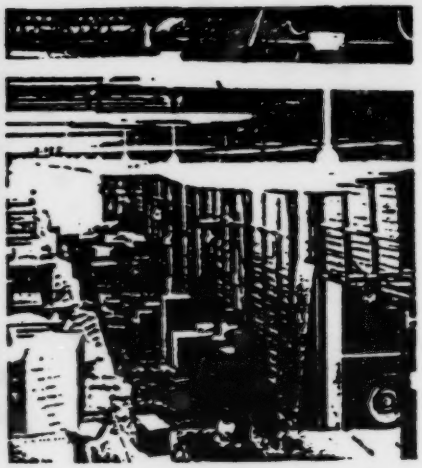
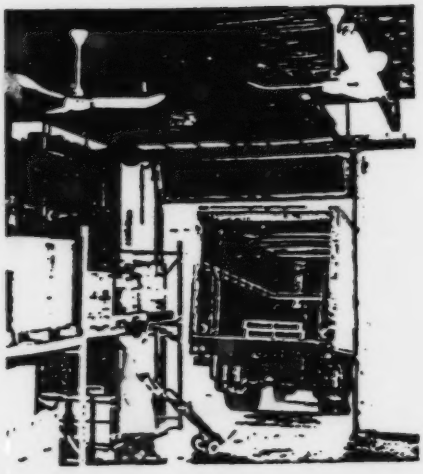
36F
FR52
60F

Ceiling Fan Systems by WILCORP







WILCORP
Environmental Systems

INDUSTRIAL MODEL

Without doubt, the broadest application for our Model 60F can be found in general industry, factories or warehouses. The combination of the aerodynamic blade design—and reliability of the capacitor startmotor, provide one of the most cost-efficient means of vertical air circulation possible.

The use of these overhead, slow moving air circulators in large open industrial spaces offers many immediate benefits for buildings with ceiling heights up to 35 feet. With the unit supported by the appropriate length of downrod, extending down 20% to 25% of the height of the building, the fan is capable of returning the stratified warm air back to floor level.

This important application of heat recovery greatly improves working conditions at floor level that are normally subject to draughts and temperatures below that of the desired thermostat setting.

Further technical information on heat recovery is outlined on the opposite page.

The fan unit is supplied complete with either a variable speed motor controller or a 5 speed choke type remote controls. An optional variable speed control of larger capacity can operate up to 10 60F units.

Our wall mounted remote controls offer a choice of speed suitable to the changing plant environment. For example, in the winter, fans would normally be set on a low speed, to improve employee comfort and simultaneously reduce fuel consumption. At this lower speed the warm air is gently pushed back to floor level, thereby satisfying both the employee and the thermostat.

However, this same fan when operated at top speed is also an effective vehicle for removing stuffy, stale hot weather conditions prevalent in so many industries. So, it is accurate to say that these unique fans are indeed useful all year long.

Increased air velocity removes body heat through evaporation at a greater rate, thereby assisting the body's own cooling system with increased evaporation (or greater summer comfort). The realities of plant environments during hot and humid summer conditions has prompted over 5,000 companies in dozens of industries [illegible] 20,000 of our

period of 8 years.

FANS ASSIST MANUFACTURING PROCESSES

These units are inexpensive vehicles for controlled vertical air delivery and are often used to assist in-plant manufacturing processes. For example, manufacturers of ceramic, clay and related products have found that tensile strength improves when water is evaporated at an even and controlled rate. This reduction of drying time increases production.

The food processing industry has also benefited from SMC's unique air pattern by keeping insects off food and removing unwanted oven heat from extended conveyor systems. Large bakeries use SMC fans to remove excess moisture from dough, enabling it to rise sufficiently before entering the oven.

REDUCE SPOILAGE

There need not be a high percentage of vegetable and fruit spoilage due to stratified hot air. By introducing continuous vertical air circulation, produce can be stored at one controlled, consistent ceiling to floor temperature.

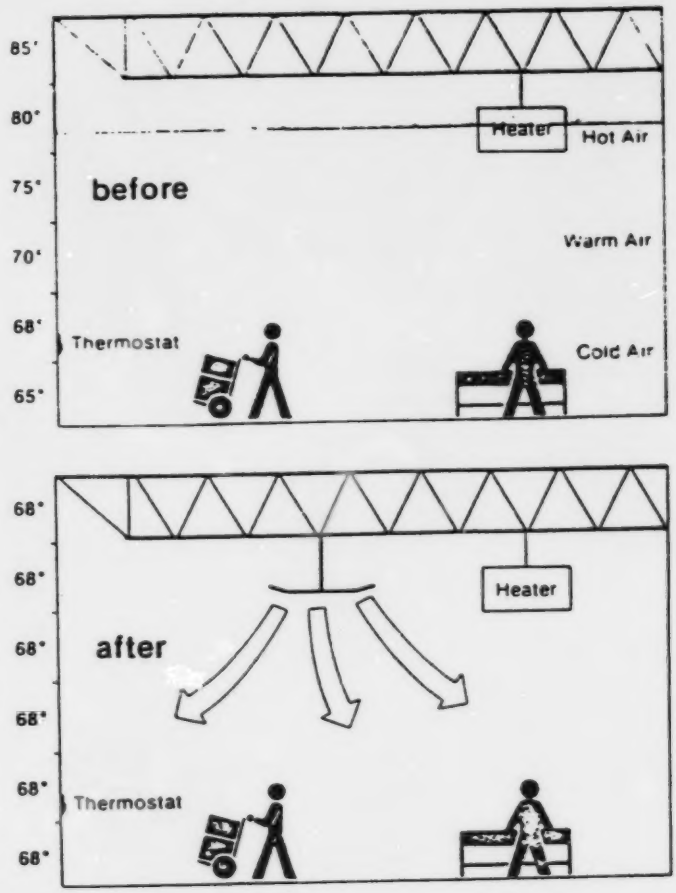
Canners and bottlers have the same problem with products that immediately stored. The excess heat rises, increasing ceiling temperatures; which in turn recooks the upper levels of food storage. Once again vertical air circulation eliminates the problem.

EFFECTIVE SERVICE AREA

Vertical air circulation is always the easiest and shortest way to move air in a building. In many of the commercial and industrial buildings with a 16-20 foot height, a total area of 1,000 square feet can be affected by our model 60F. Manufacturers employing large numbers of people in a concentrated assembly area would use a 60F for every 400–600 square feet. On the other hand, warehouses that are primarily concerned with the heat recovery application of our units may use one fan for every 2,000 square feet.

MANAGEMENT'S VEHICLE

With so many labour relations and government regulations now turning to improve plant working conditions, many managers and plant engineers have already discovered that these inexpensive high volume air circulators will satisfy both the union and the De-



ENERGY CONSERVATION. HEAT RECOVERY

The necessity of energy conservation is slowly seeping into the public awareness. Nevertheless many government officials in both U.S. and Canada foresee brownouts and blackouts becoming a regular occurrence before 1980. Until recently, the cost of heating and cooling an industrial or commercial building represented a small percentage of operating cost. The cost of heating a building is now a significant percentage of overhead and is still rising.

IN-PLANT ALTERNATIVE

By using a system of our overhead air circulators, heating fuel requirements can be reduced and employee comfort greatly improved.

Air temperature in the typical industrial situation stratifies at the rate of ¾°F per lineal foot of elevation at design temperature. Our research confirms this rule of thumb and in many instances, because of process heat from ovens, heat treating equipment, plating tanks etc., the temperature difference between ceiling and floor is greater than ¾°F per foot.

Without losing employee comfort, in most cases the ceiling to floor differential can be reduced substantially. Consequently the thermostat becomes for the first time a more accurate measure of the air temperature throughout the whole of the building. Heat loss calculations before and after the installation of these "heat recirculators" reveal a startling difference in BTU loss and therefore heating requirements to meet design temperature.

In order to assist owners of existing buildings, and also as a service to the mechanical engineer or architect, we have developed a simple computer assisted building analysis.

Savings of over 40% in fuel consumption have been reported, but generally speaking, most total plant systems reduce oil or gas consumption by 15 to 25%. With a pay back of the original investment in 2 to 3 years and an initial cost of .20¢ per square foot installed, this all season system is a viable alternative to rising fuel costs and changing government standards for working conditions.

As fuel becomes less available and more expensive, the issue surrounding heat recovery and energy conservation will undoubtedly be examined closer by all.

TECHNICAL ASSISTANCE

Further information on the "Computer Building Analysis", the mini-in-plant system, or the loading door protection package, is readily available from any one of our dealers or trained representatives.

FAN MODEL	DESCRIPTION	No. of Speeds	CFM Air Del.	RPM High/Low	Floor Area Affected	Max. Air Velocity	VOLTS	WATTS High/Low	Gross Weight
Contemp									
36F	36" Vertical downward thrust fan.	Variable	7050	375/185	900 Sq. Ft.	750 Ft/min.	115-120V	90/28	23 lbs.
36S	36" (Sealed against moisture) Construction same as 36F	Variable	7050	375/185	900 Sq. Ft.	750 Ft/min.	115-120V	90/28	23 lbs.
Contemp									
60A	56" Vertical upward draught (sealed for moisture-arena environment)	1	12,000	225/—	1100 Sq. Ft.	600 Ft/min.	115-120V	157/—	34 lbs.
60F	56" Vertical downward thrust	5 spd or Variable	16,800	285/102	1500 Sq. Ft.	660 Ft/min.	115-120V	157/67	36 lbs.
60R	56" Vertical upward draught (evacuation of in plant pollutants)	1	12,000	225/—	1100 Sq. Ft.	600 Ft/min.	115-120V	157/—	34 lbs.
60S	56" (sealed against moisture) Construction same as 60F	5 spd or Variable	16,800	285/102	1500 Sq. Ft.	660 Ft/min.	115-120V	157/67	36 lbs.
Antique									
FR36	36" Antique style downward thrust	2 spd or Variable	4,000	325/250	400 Sq. Ft.	N/A	115-120V	80/55	30 lbs.
FR52	52" antique style downward thrust	2 spd or Variable	7,000	220/140	650 Sq. Ft.	N/A	115-120V	122/85	60 lbs.

MANUAL COMFORT CONTROLS

Model 60F can be remotely controlled by a 5 position choke type speed control.(FIG.1)

A new full range motor control is now available for all models. Reliable solid state miniature electronics have made it possible for the control to be recessed into a standard outlet box.(FIG.2)

AUTOMATIC THERMOSTAT SPEED CONTROL

We have also developed a heat sensitive master control that can automatically increase the speed of several fans simultaneously relative to changing plant environment.

Fig. 1

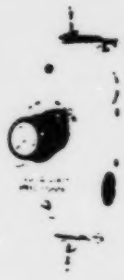


Fig. 2

ASSEMBLY

1 Unpack the fan, see whether components and parts are complete and in good condition (see below)
2 Check the rating plate on the motor head(11) to see whether the voltage and frequency correspond to your power supply.
3 Slip the upper canopy(3) and lower canopy(5) onto the down rod(1).
4 Thread the lead out wire(2) into the down rod(1) and connect to the wire junction(10).
5 Insert the down rod(1) into the capacitor housing(8) and fix it with pivot pin(7) and cotter pin(6).
6 Fix the lower canopy(5) into the down rod(1) with set screw(4).
7 Fix the blades(13) firmly onto the motor head(11) by screws and washers(12).
8 Hang the fan on the hanger hook (steel or wood)
9 Tighten the upper canopy(3) onto the upper end of the down rod(1) by set screws(4)

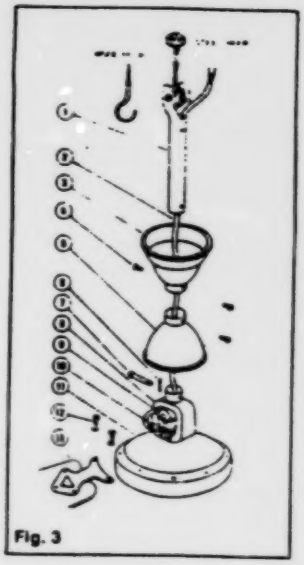


Fig. 3

INSTALLATION, COMMERCIAL

Joist mounting (Fig. 6)

Generally recommended for new construction or where light fixture can be removed in existing home. Center knock-out slug is removed from outlet box so hooklag screw can be firmly secured in the joist. Drilling a ¼" diameter pilot hole will facilitate inserting the screw thread.

Mid-joist mounting (Fig. 4 & 5)

For new or existing homes. A 2" x 6" (to prevent splitting) support member is nailed between joists so the bottom of the clamp-type outlet box is flush with ceiling line. The center knock-out slug is removed and the hook lag screw inserted into a ¼" diameter drilled pilot hole. On existing outlets, the small steel support strap should be replaced with a 2" x 6" to provide adequate strength.

INSTALLATION, INDUSTRIAL

As in Fig. 3, all units are supplied with a wood and steel hook for wood or steel truss mounting.

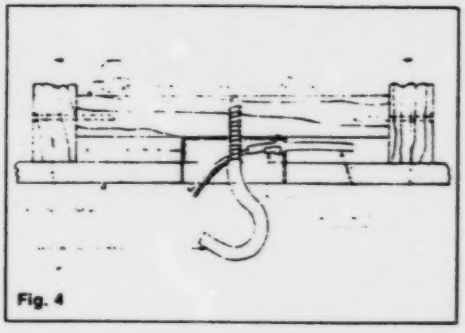


Fig. 4

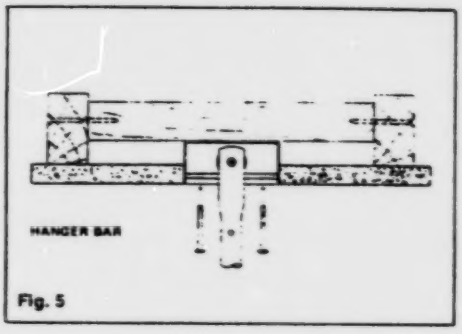


Fig. 5

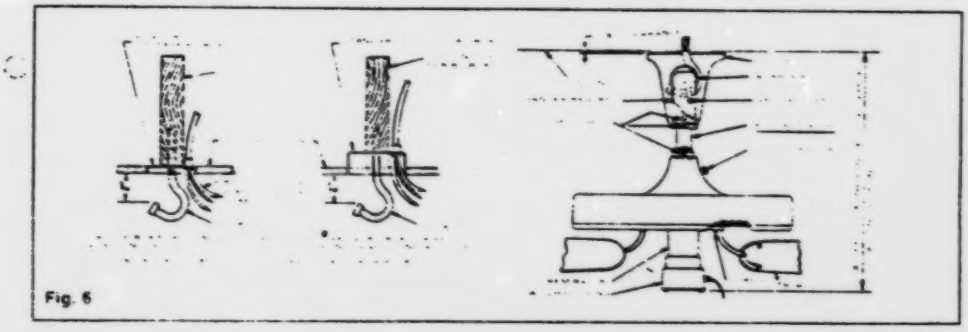


Fig. 6

WILCORP'S WARRANTY FOR ANTIQUE AND CONTEMPORARY CEILING FANS

Wilcorp Manufacturing Limited warrants both contemporary and antique type fans to be free from defect of material or workmanship, present at the time of shipment from the factory, for a period of 3 years after the date of receipt by the original purchaser.

We agree to correct such defects without charge during the period of this warranty, if the complete product is returned pre-paid to the nearest Distributor.

To obtain warranty service you must present a copy of the bill of sale as proof of purchase. Damage or misuse or by affixing any unauthorized accessories or attachments is not covered by this warranty. Servicing performed by unauthorized service agents will render this warranty invalid.

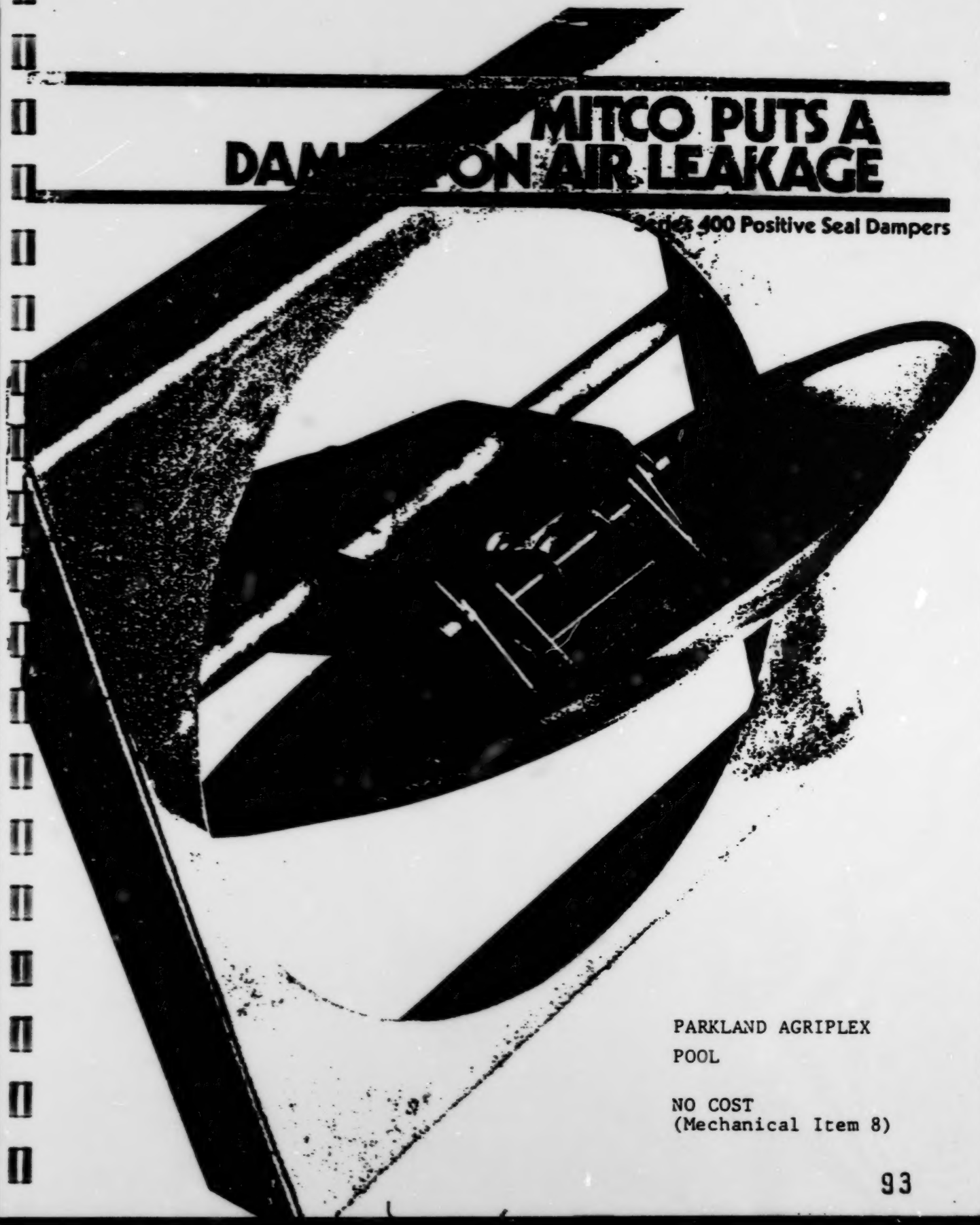
This warranty is in lieu of all other guarantees, either expressed or implied and is valid only in Canada, and the United States.

May we suggest that you contact your dealer to obtain the name of our nearest Authorized Service Distributor.

MID-CAN MECHANICAL SALES
BOX 1031 - SASKATOON, SASK.
PHONE (306) 664-2915

WILCORP/FANFAIR

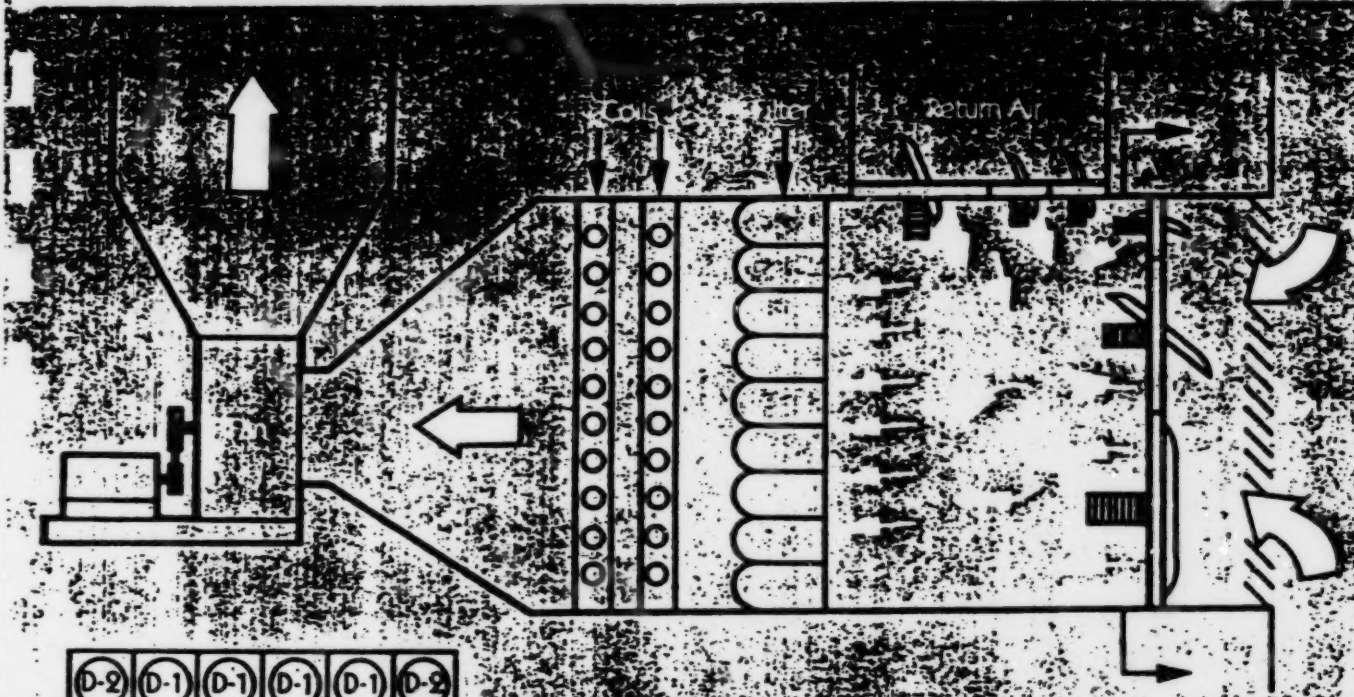
Wilcorp Manufacturing Ltd
115 Tycos Drive
Toronto Ontario M6B 1W3
Telephone (416) 789-1164
Telex 06-23334

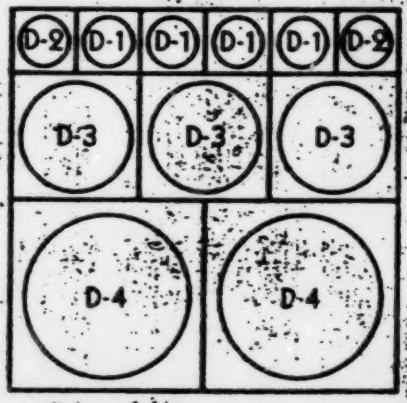


PARKLAND AGRIPLEX
POOL

NO COST
(Mechanical Item 8)

TYPICAL INSTALLATION





To produce continuous, accurate volume control, the dampers are provided in various sizes with various operator spring ranges.

As the economizer control increases line pressure, the dampers are opened; the smallest ones first, then the larger ones. Dampers can be positioned in all directions. In this example, dampers are positioned so that top rows open first and air is deflected towards entering return air.

See installation and maintenance instruction sheet for proper installation procedure.

Mark #	Model	Size	Spring Range	Control	Remarks
D-1	Mitco 400-VVS	12"	5-10	NC	Minimum outside air
D-2	Mitco 400-VVS	12"	4-8	NC	Variable outside air
D-3	Mitco 400-VVS	24"	8-13	NC	Variable outside air
D-4	Mitco 400-VVS	36"	10-15	NC	Variable outside air

POSITIVE SEAL DAMPER

Standard Construction

Standard Dimensions (inches)

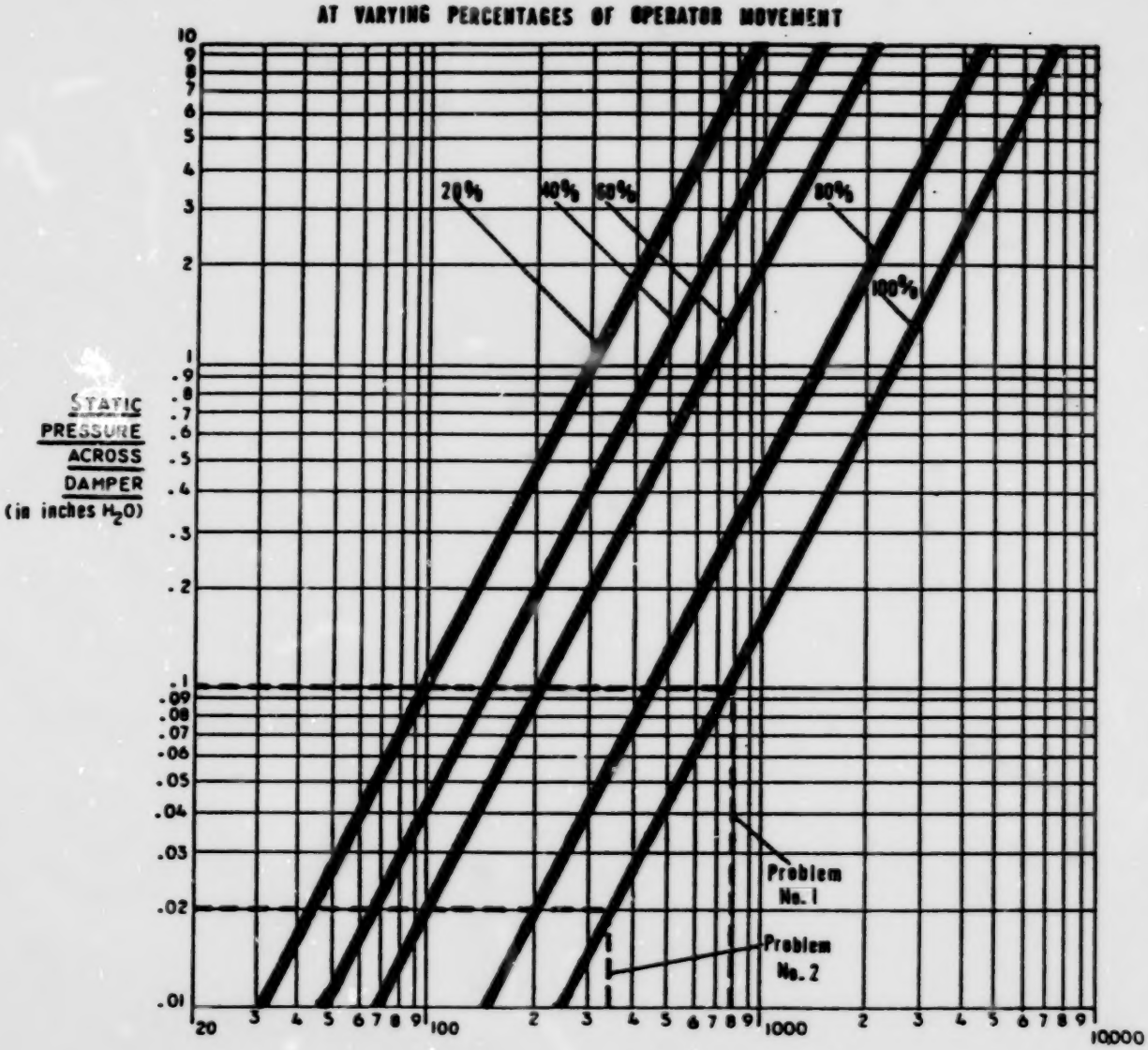
Model	A	B	C	D	E
90			7	10½	
120			10	20	
150			11	21	

Ordering Example

Options

PRESSURE DROP VS. FACE VELOCITY

AT VARYING PERCENTAGES OF OPERATOR MOVEMENT



FACE VELOCITY (IN F.P.M. OVER ENTIRE DAMPER AREA)

Problem #1

Given an allowed pressure drop of .1" w.g., what size dampers are used to handle 6000 cfm?

Solution:

From the graph, we are allowed a 800 fpm face velocity. Therefore, 6000 cfm ÷ 800 fpm = 7.5 ft^2. We can use one 36" module since its area

Problem #2

Find the pressure drop across a 24" square series 400 damper module handling 1400 cfm.

Solution:

The area of a 24" square module is 4 $ft.^2$. Therefore, 1400 cfm ÷ 4 $ft.^2$ = 350 fpm face velocity. From graph S.P. = .02 in. w.g.

c) ELECTRICAL

POOL

.1 The light levels in the swimming area should be increased in accordance with the Public Health Act. Replace the 400 watt mercury fixtures with 400 watt high pressure sodium units. Light level should increase by a factor of 2.1.

.2 Change area lighting may be reduced.

.3 Shower area fixtures should be changed to vapour-proof fluorescent to increase the light level.

.4 Pool lounge incandescent fixtures should be replaced with fluorescent.

Cost Comparioson:

Incandescent -

Energy - 29 filtures x .150 x $.0186 1 3816 hour = $308.75

Demand - 29 fixtures x .150KW x $6.65/KW x 12 months = 347.13

$655.88

Annual Energy Billing + 10% surcharge + 5% E & H Tax = $757.54

Lamps - 29 fixtures x $\frac{3816 \text{ hour}}{1500 \text{ hour}}$ x 1.6 = $118.04

Labour - 29 fixtures x $\frac{3816 \text{ hour}}{1500 \text{ hour}}$ x $\frac{.1 \text{ hour}}{\text{lamp}}$ x 15 = $110.66

Total Annual Incandescent Cost = $986.25

If they are replaced with 15 fluorescent fixtures -

Energy - .095 KW x 15 fixtures x .1086 x 3816 hour = $110.14

Demand - .095 KW x 15 fixtures 1 $6.65 1 12 months = 113.71

$214.85

Fluorescent Energy Billing + 10% surcharge + 5% E & H Tax = $248.16

Lamps - .50 x 2 x 15 = $15.00

Total Annual Fluorescent Cost = $263.16

Annual Savings = $986.25 - $263.16 = $723.09

Cost to replace 29 incandescent fixtures with 15 fluorescent:

15 x $75.00 = $1,125.00

Payback period = $\frac{\$1,125.00}{\$723.00}$ = 1.55 years.

A. ARCHITECTURAL

POOL

HIGH COST

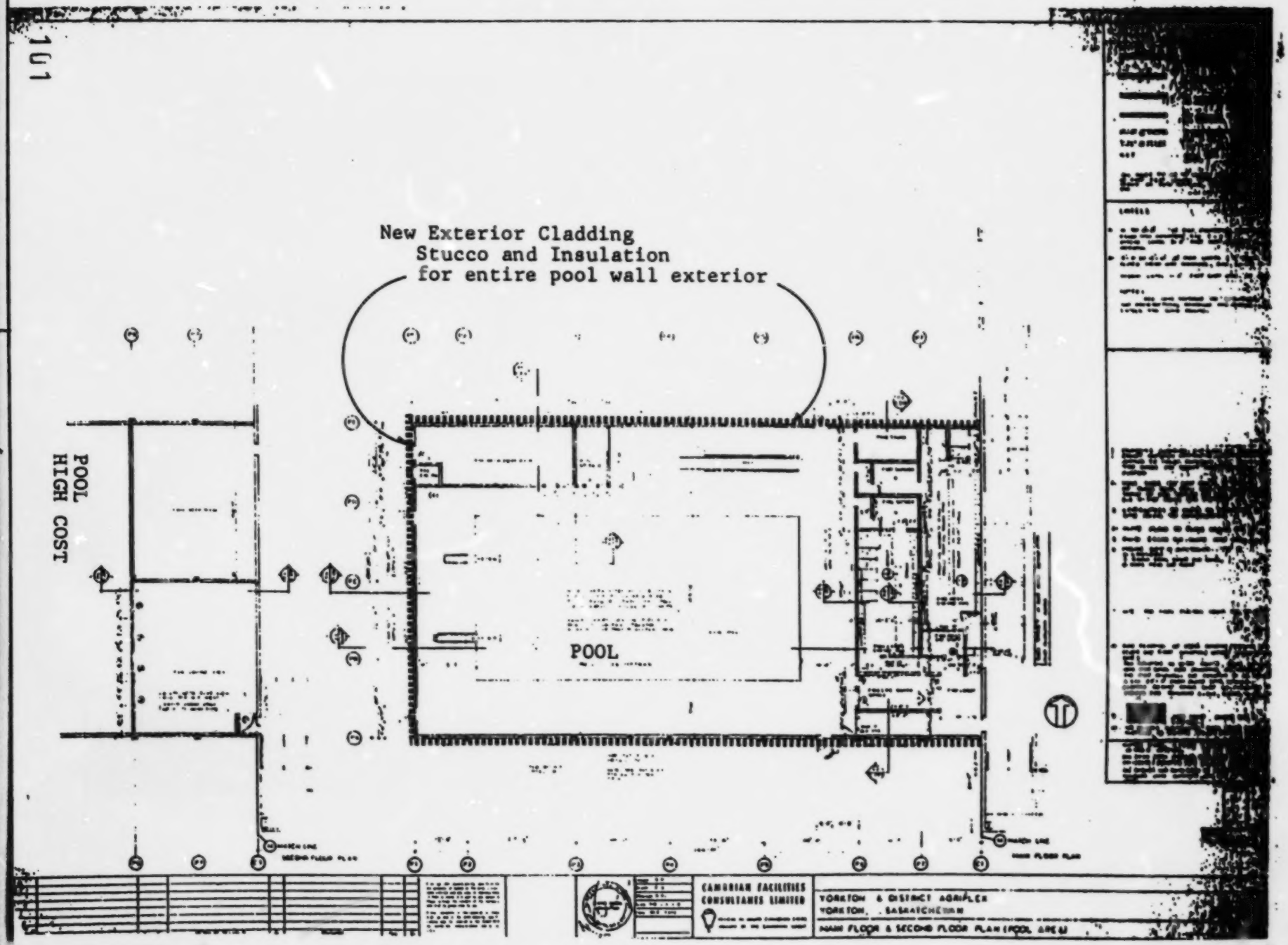
1. When reviewing the attached thermal scan report it is quite obvious that a great deal of thermal bridging exists in the exterior wall. The previously mentioned foam glass insulation only addresses a small portion of the total wall.

   This is characteristic of this type of construction and in our opinion one cannot accept the stated R-value of the vermiculite insulation as stated in the manufacturer's literature when applied in a single wythe concrete block structure. As the photographs clearly show, there exists a tremendous amount of thermal bridging.

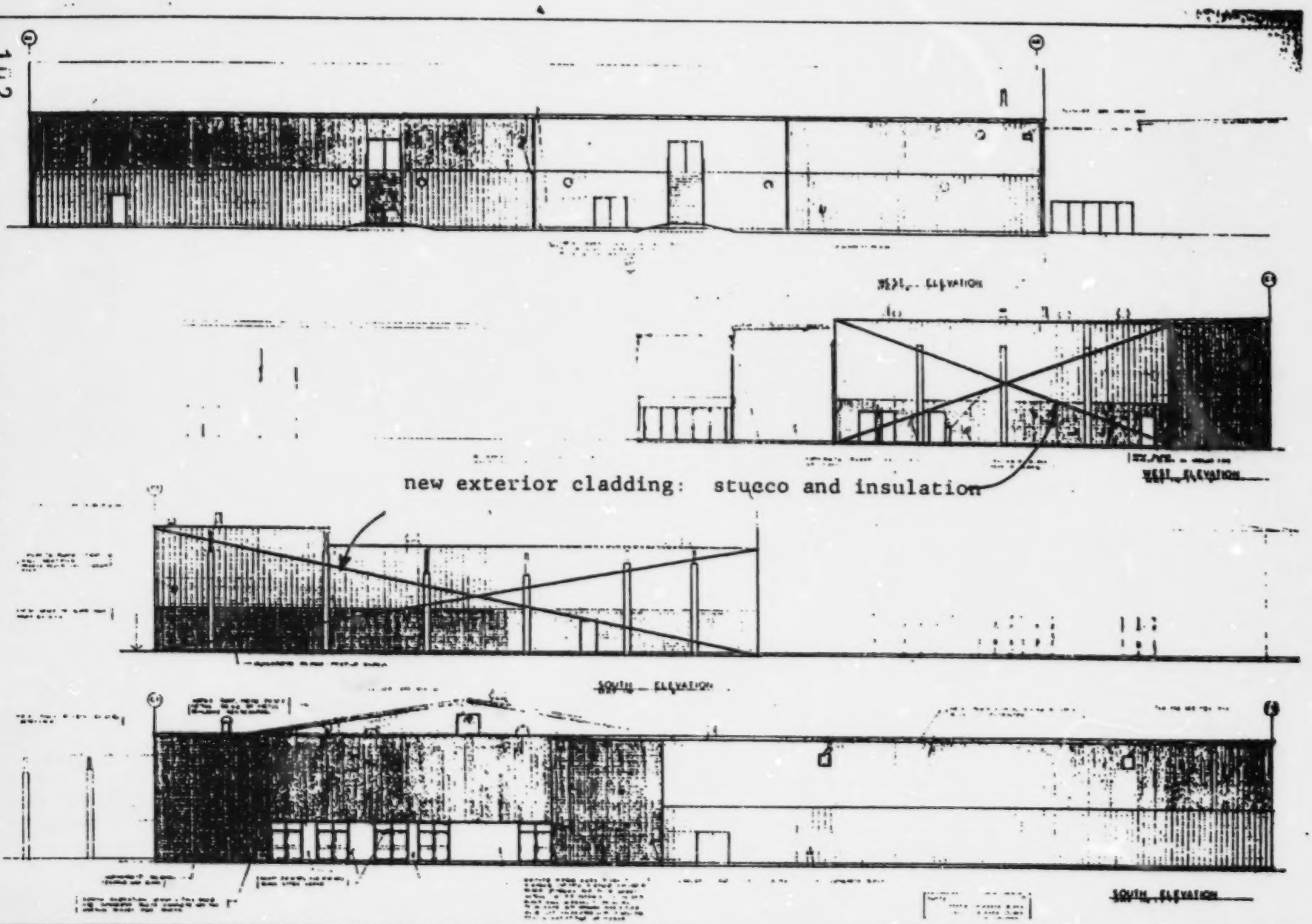
   For a high humidity facility it is imperative that the entire envelope is of a proper construction; We therefore suggest that over the concrete block wall and pilasters to the exterior a new skin is constructed consisting of metal furring, 2 inch rigid insulation and stucco cover. This detail would carry right up to the top of the wall and over the beam ends. The cost of this work should not exceed $32,200.

We anticipate an annual saving of 467,157 MBTU or $1,406 based on $3.01 per MCF or a payback of 22.9 years. It must here be noted that because of the thermal bridging and beam/column construction the entire wall envelope is under stress and that the above measure will have other benefits over and above those which are energy related. With a set back temperature to 62 degrees Fahrenheit, an annual saving of $1,530 can be realized or a payback of 21 years.

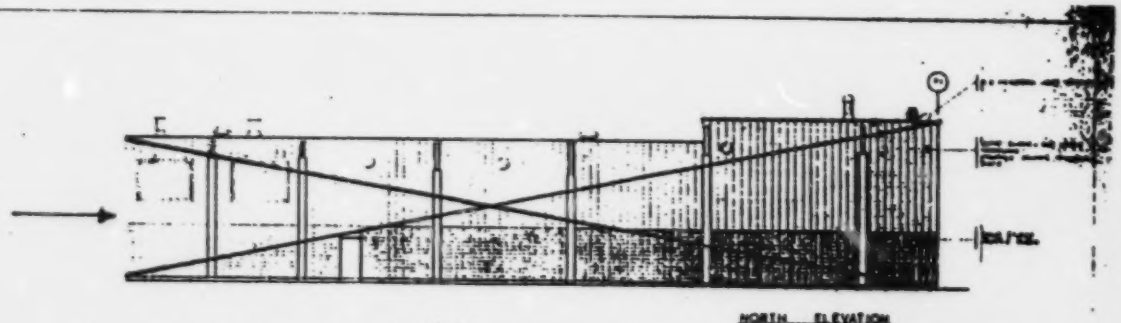
2. Because of weather conditions it was impossible to do a proper roof scan. However, it would seem that the roofing is not a high humidity application. We also took some direct temperature readings on the roof and noticed some thermal problem areas. We would suggest that a roof-scan would be beneficial to pinpoint weak areas. However, we do recommend additional insulation to the roof area to raise the dew point and thus protect the wood deck as well as reduce the energy loss. The system we propose would be a single layer of 6 inches rigid insulation laid loose over existing roofing. The insulation should have a coat of white exterior latex paint to protect against ultra-violet light which will deteriorate unprotected rigid insulation. The insulation would be weighed down with patio blocks at intersections and along perimeter. The cost of this installation should not exceed $16,700. This addition will result in an annual saving of 359,173 MBTU or $1,081, resulting in a payback of 15 years.


101
New Exterior Cladding
Stucco and Insulation
for entire pool wall exterior
POOL
HIGH COST
POOL
CANADIAN FACILITIES CONSULTANTS LIMITED
YORKTON & DISTRICT AGRIPLEX
YORKTON, SASKATCHEWAN
MAIN FLOOR & SECOND FLOOR PLAN (POOL AREA)

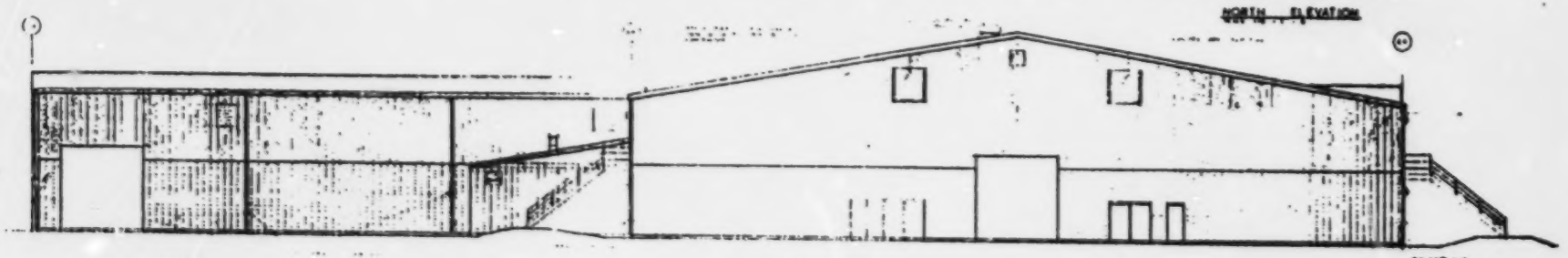
1 1/2 PARKLAND AGRIPLEX - POOL - HIGH COST



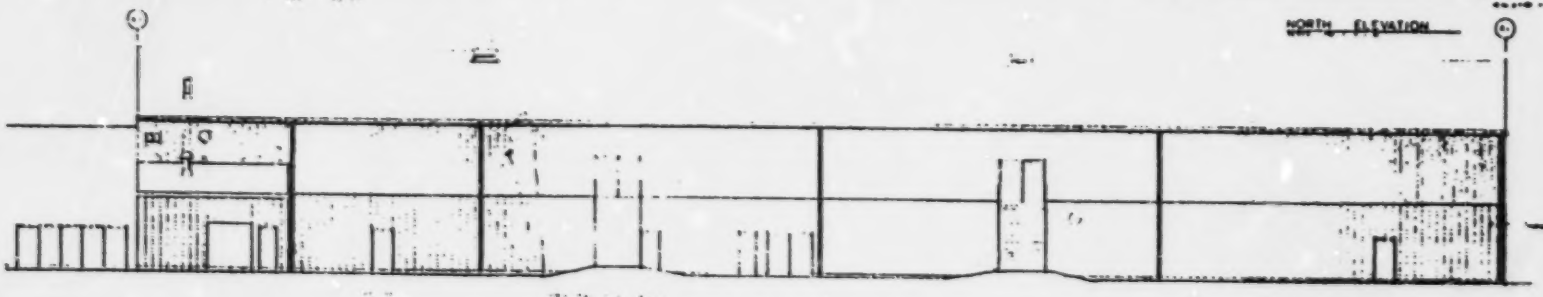
new exterior envelope to entire pool wall area



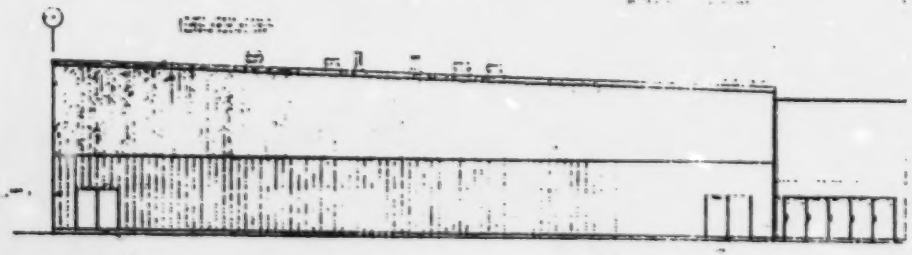
NORTH ELEVATION



NORTH ELEVATION



EAST ELEVATION



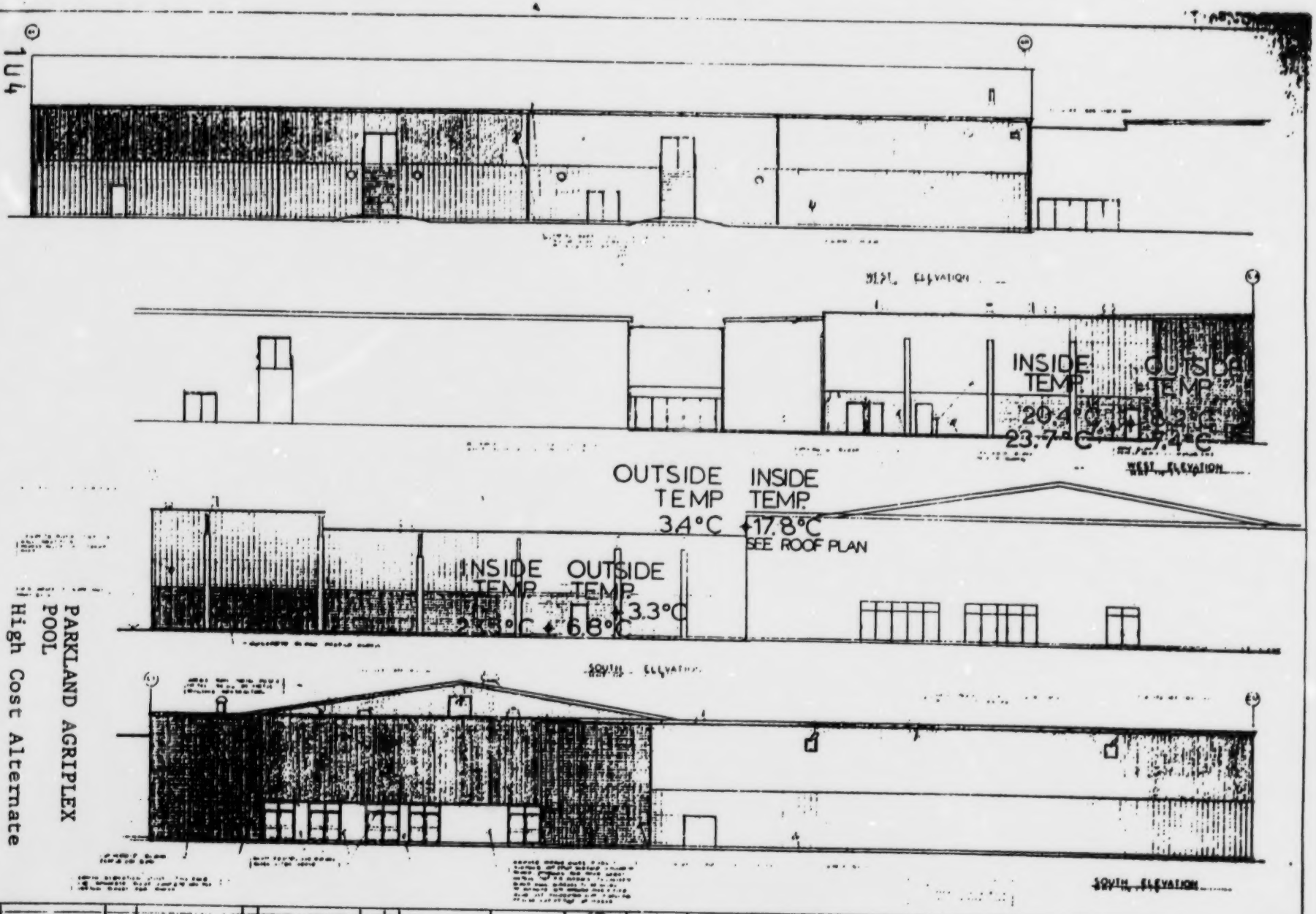
EAST ELEVATION

PARKLAND AGRIPLEX
POOL

HIGH COST

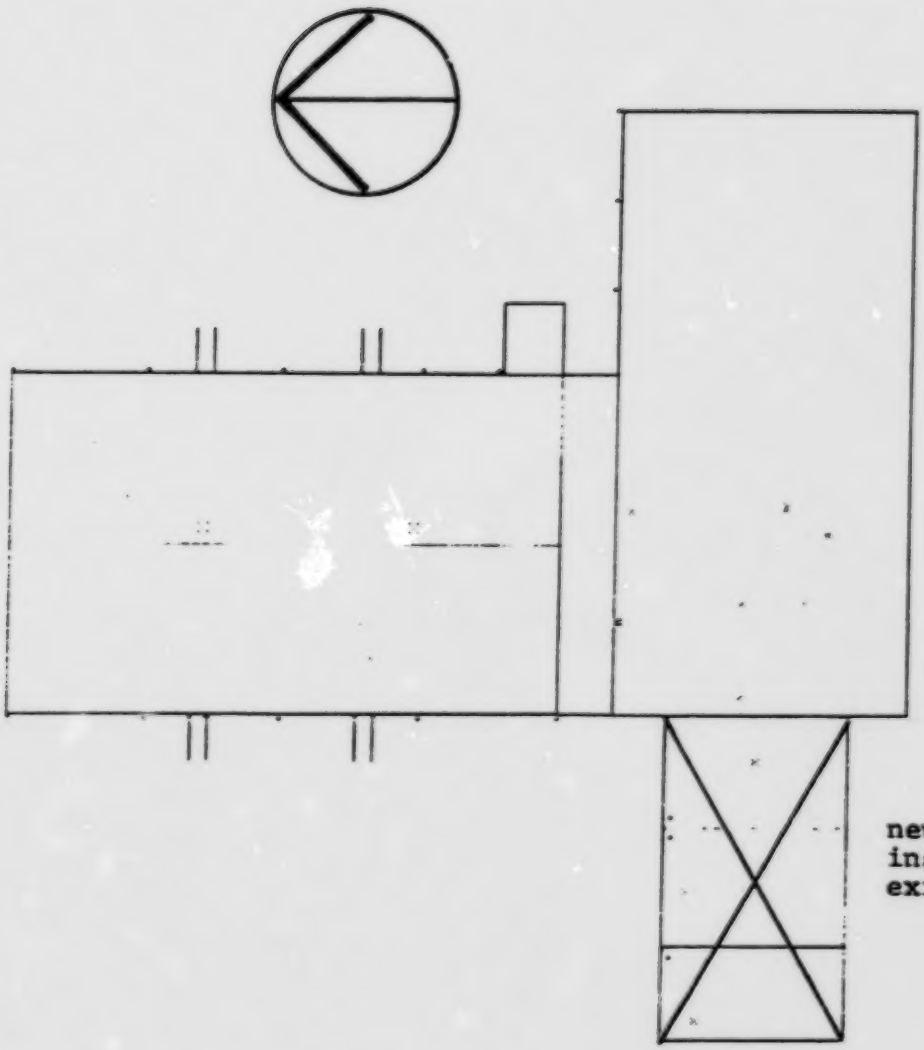
CAMBRIAN FACILITIES CONSULTANTS LIMITED

YORKTON & DISTRICT AGRIPLEX
YORKTON SASKATCHEWAN
ELEVATIONS


1U4
INSIDE TEMP
OUTSIDE TEMP
20.4°C
23.7°C
OUTSIDE TEMP
3.4°C
INSIDE TEMP
17.8°C
SEE ROOF PLAN
INSIDE TEMP
OUTSIDE TEMP
3.3°C
6.8°C
PARKLAND AGRIPLEX
POOL
High Cost Alternate
CANADIAN FACILITIES CONSULTANTS LIMITED
YORKTON & DISTRICT AGRIPLEX
YORKTON SASKATCHEWAN
ELEVATIONS
A-207

PARKLAND AGRIPLEX
POOL

High Cost Alternate



PARKLAND AGRIPLEX
POOL

HIGH COST

[YORKTON AGRIPLEX POOL YORKTON]

INSULATION PROGRAM

MOST INDUSTRIAL AND COMMERCIAL BUILDINGS ARE POORLY INSULATED.

THIS RESULTS IN OVERSIZED HEATING PLANTS, WASTAGE OF HEATING FUELS, AND EMPLOYEE DISCOMFORT.

THIS PROGRAM WILL SHOW HOW MUCH HEAT CAN BE SAVED BY APPLICATION OF ADEQUATE INSULATION TO THE ROOF, WALLS, WINDOWS, AND OUTSIDE GROUND WALL EDGE. IT WILL ALSO INDICATE THE EFFECT OF THERMOSTAT SET-BACK ON ENERGY CONSUMPTION.

FOR THE PURPOSE OF THIS DEMONSTRATION WE WILL ASSUME TRANSMISSION HEAT LOSS ONLY.

INPUT THE FOLLOWING DATA (EXISTING CONDITIONS ONLY):

1) PLANT LENGTH (FT)
(IF UNKNOWN, ENTER ZERO)? 0
PLANT PERIMETER (FT)? 1000
PLANT AREA (SQ FT)? 11520
CALCULATED PLANT LENGTH (FT)? 24.2125
2) CALCULATED PLANT WIDTH (FT)? 475.788
3) PLANT HEIGHT (FT)? 10.288
4) DAYS IN HEATING SEASON ? 326
5) DEGREE DAYS (BASED ON 65 DEG F)? 11426
6) R-FACTOR OF ROOF (SQ FT.HR.DEG F/BTU)? 11.97
7) R-FACTOR OF WALLS (SQ FT.HR.DEG F/BTU)? 4.55
8) WINDOW AREA (%)? 0
9) NO WINDOWS.
10) SLAB EDGE HEAT LOSS PER LINEAR FOOT (BTU/HR/FT)
(NO INSULATION = 50.0000, R6 INSULATION = 25.0000)? 25
11) TEMPERATURE INSIDE THE PLANT (DEG F)? 80
12) HOURS PER WEEK AT THIS TEMPERATURE? 168
13) NO SET-BACK.
14) STRATIFICATION TEMPERATURE DIFFERENCE (DEG F)? 15
15) INTERNAL HEAT GAIN (%) ? 0
16) TYPE OF FUEL ? NATURAL GAS
17) COST OF FUEL IN DOLLARS PER MCF ? 3.01
18) HEATING PLANT EFFICIENCY (%) ? 75

[YORKTON AGRIPLEX POOL YORKTON]

INSULATION PROGRAM (CONTINUED)

EXTERIOR SECTION	ENERGY USAGE (MBTU/YEAR)	PRESENT COST ($/YEAR)
ROOF	653,081	$1,966
WALLS	1,180,550	$3,553
WINDOWS	0	$0
SLAB EDGE	260,800	$785
TOTAL	2,094,430	$6,304

IF EXISTING STRATIFICATION IS CORRECTED,
YOU CAN SAVE ANNUALLY UP TO $453.

INSULATION PROGRAM (CONTINUED)

MODIFICATIONS:

7) R-FACTOR OF WALLS (SQ FT.HR.DEG F/BTU)? 23.83

EXTERIOR SECTION	ENERGY USAGE (MBTU/YEAR)	($/YEAR)	SAVINGS (MBTU/YEAR)	($/YEAR)
ROOF	653,081	$1,966	0	$0
WALLS	225,489	$678	955,139	$2,875
WINDOWS	0	$0	0	$0
SLAB EDGE	260,800	$785	0	$0
TOTAL	1,139,290	$3,429	955,139	$2,875

IF EXISTING STRATIFICATION IS CORRECTED,
YOU CAN SAVE ANNUALLY UP TO $453.

[YORKTON AGRIPLEX POOL YORKTON]

INSULATION PROGRAM (CONTINUED)

MODIFICATIONS:

7) R-FACTOR OF WALLS (SQ FT.HR.DEG F/BTU)? 17.57

EXTERIOR SECTION	ENERGY USAGE (MBTU/YEAR)	($/YEAR)	SAVINGS (MBTU/YEAR)	($/YEAR)
ROOF	653,081	$1,966	0	$0
WALLS	305,719	$920	874,828	$2,633
WINDOWS	0	$0	0	$0
SLAB EDGE	260,800	$785	0	$0
TOTAL	1,219,600	$3,671	874,828	$2,633

IF EXISTING STRATIFICATION IS CORRECTED,
YOU CAN SAVE ANNUALLY UP TO $453.

INSULATION PROGRAM (CONTINUED)

MODIFICATIONS:

6) R-FACTOR OF ROOF (SQ FT.HR.DEG F/BTU)? 41.97

EXTERIOR SECTION	ENERGY USAGE (MBTU/YEAR)	($/YEAR)	SAVINGS (MBTU/YEAR)	($/YEAR)
ROOF	186,261	$561	466,820	$1,405
WALLS	1,180,550	$3,553	0	$0
WINDOWS	0	$0	0	$0
SLAB EDGE	260,800	$785	0	$0
TOTAL	1,627,610	$4,899	466,820	$1,405

IF EXISTING STRATIFICATION IS CORRECTED,
YOU CAN SAVE ANNUALLY UP TO $129.

INSULATION PROGRAM (CONTINUED)

MODIFICATIONS:

12) HOURS PER WEEK AT THIS TEMPERATURE? 105
13) SET-BACK TEMPERATURE (DEG F)? 55

EXTERIOR SECTION	ENERGY USAGE (MBTU/YEAR)	($/YEAR)	SAVINGS (MBTU/YEAR)	($/YEAR)
ROOF	558,957	$1,682	94,123	$283
WALLS	959,411	$2,888	221,136	$666
WINDOWS	0	$0	0	$0
SLAB EDGE	260,800	$785	0	$0
TOTAL	1,779,170	$5,355	315,260	$949

IF EXISTING STRATIFICATION IS CORRECTED, YOU CAN SAVE ANNUALLY UP TO $453.

INSULATION PROGRAM (CONTINUED)

MODIFICATIONS:

12) HOURS PER WEEK AT THIS TEMPERATURE? 105
13) SET-BACK TEMPERATURE (DEG F)? 62

EXTERIOR SECTION	ENERGY USAGE (MBTU/YEAR)	($/YEAR)	SAVINGS (MBTU/YEAR)	($/YEAR)
ROOF	585,312	$1,762	67,769	$204
WALLS	1,021,330	$3,074	159,218	$479
WINDOWS	0	$0	0	$0
SLAB EDGE	260,800	$785	0	$0
TOTAL	1,867,440	$5,621	226,987	$683

IF EXISTING STRATIFICATION IS CORRECTED,
YOU CAN SAVE ANNUALLY UP TO $453.

YORKTON AGRIPLEX POOL YORKTON]

INSULATION PROGRAM (CONTINUED)

MODIFICATIONS:

6) R-FACTOR OF ROOF (SQ FT.HR.DEG F/BTU)? 41.97
7) R-FACTOR OF WALLS (SQ FT.HR.DEG F/BTU)? 17.57
12) HOURS PER WEEK AT THIS TEMPERATURE? 105
13) SET-BACK TEMPERATURE (DEG F)? 62

EXTERIOR SECTION	ENERGY USAGE (MBTU/YEAR)	($/YEAR)	SAVINGS (MBTU/YEAR)	($/YEAR)
ROOF	166,933	$502	486,148	$1,463
WALLS	264,488	$796	916,060	$2,757
WINDOWS	0	$0	0	$0
SLAB EDGE	260,800	$785	0	$0
TOTAL	692,221	$2,084	1,402,210	$4,221

IF EXISTING STRATIFICATION IS CORRECTED,
YOU CAN SAVE ANNUALLY UP TO $129.

INSULATION PROGRAM (CONTINUED)

MODIFICATIONS:

6) R-FACTOR OF ROOF (SQ FT.HR.DEG F/BTU)? 41.97
7) R-FACTOR OF WALLS (SQ FT.HR.DEG F/BTU)? 17.57
12) HOURS PER WEEK AT THIS TEMPERATURE? 105
13) SET-BACK TEMPERATURE (DEG F)? 55

EXTERIOR SECTION	ENERGY USAGE (MBTU/YEAR)	($/YEAR)	SAVINGS (MBTU/YEAR)	($/YEAR)
ROOF	159,417	$480	493,664	$1,486
WALLS	248,453	$748	932,094	$2,806
WINDOWS	0	$0	0	$0
SLAB EDGE	260,800	$785	0	$0
TOTAL	668,670	$2,013	1,425,760	$4,292

IF EXISTING STRATIFICATION IS CORRECTED,
YOU CAN SAVE ANNUALLY UP TO $129.

B. MECHANICAL

POOL

HIGH COST

1. Dehumidification System:

At present the ventilation system complete with exhaust fans runs virtually continuously in order to control the humidity level and heat the pool area.

Although the energy consumption for this area is not metered separately, we have used the modified "degree day" method taken from the ASHRAE Handbook as an approximation.

The probable gas consumption on a yearly basis is calculated as follows:

$$E = \frac{(Hl \times D \times 24)}{(\text{Delta } T \times n \times V)} (Cd)\ (Cf)$$ where:

E	=	Gas consumption for one year (Ft^3)
Hl	=	Design heat loss, including infiltration, BTU/hr
D	=	Number of $65^{\circ}F$ degree days for the typical year
Delta T	=	Design temperature difference, $^{\circ}F$
n	=	Rated full load efficiency, decimal
V	=	Heating value of fuel, consistant with Hl and D
Cd	=	Interim part-load correction factor for fueled system
E	=	Is the figure that we are calculating, in Ft^3/year
Hl	=	Total heat required to ventilate and heat the space at design winter conditions.

$$H1 = 1.08 \times \text{Delta T} \times \text{cfm}$$
$$= 1.08 \times 135 \times 15{,}000$$
$$= 2{,}187{,}000 \text{ BTU/hr}$$

D = Degree days for Yorkton = 10,850

Delta T = 125° (-40° + 85°)

n = 0.90, this figure is higher than normal, in that, part of the gas fired heating equipment is direct fired with an efficiency of 100%.

V = One F^3 of natural gas rated at 1,000 BTU

Cd = 0.43, at an outdoor design temperature of -40°F the correction factor for heating effect vrs degree days is 0.43, (ASHRAE Table)

Cf = 1.40/part-load correction factor for fuel fired equipment from ASHRAE Table.

$$E = \frac{(2{,}187{,}000 \times 10{,}850 \times 24)}{(125 \times 0.90 \times 1{,}000)} (0.43)(1.40)$$

$$= 3{,}047{,}430 \text{ Ft}^3\text{/year gas consumption}$$

In addition to the natural gas consumption the ventilation and heating system includes the operation of a 11 kW supply air fan motor and 3 x 2.2 kW exhaust air fan motors. These fans are operated 24 hours a day, year round.

Electric Energy Consumption = 11 kW + 3 x 2.2 kW

= 17.6 kW less 80% (actual amp draw is less than name plate)

= 15 kW

Energy used to power the ventilation system on a yearly basis.

= 365 x 24 x 15

= 131,400 KWH

The natural gas and power consumption represents a yearly cost of $14,398 using 1981 energy costs at 4¢/kWH and $3.00/MCF.

Proposed Change

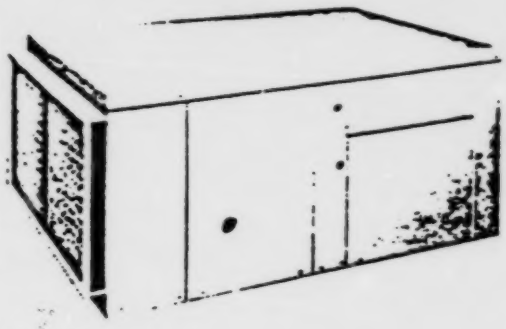
In order to reduce energy consumption in this area, we propose the addition of an electric dehumidifier specifically designed for swimming pool use. The unit could simply be added to the existing ventilation system and would virtually eliminate the need for fresh outside air and exhaust air to control humidity.

The dehumidifying electric heat pump is very efficient, reducing total ventilation energy consumption by as much as 80%. The heat being given off by the heat pump condenser as the unit dehumidifies the air in the pool area is returned to the pool water and in turn reduces the load on the pool heater.

The type of unit proposed is a "DECTRON DRY-O-TRON" Model DS-35 (see literature attached).

The installed cost of this system will be approximately $80,000 and in similar installations in Canada the payback period has been approximately 4 years. A slightly larger installation in a Public Pool in Ottawa, Ontario (using two heat pumps, a DS-35 and a DS-25) reduced the energy consumption by approximately $80,000 in the first year of operation.

Due to the retrofit nature of this installation and taking into consideration the energy saved in pool heating, we would approximate the simple payback at between seven and nine years.



DRY-O-TRON®

HEAT PUMP, WATER HEATER AND DEHUMIDIFIER

FOR: INDOOR POOLS, WHIRL POOLS, SPAS & HOT TUBS

puts an end to uncomfortable and destructive humidity!

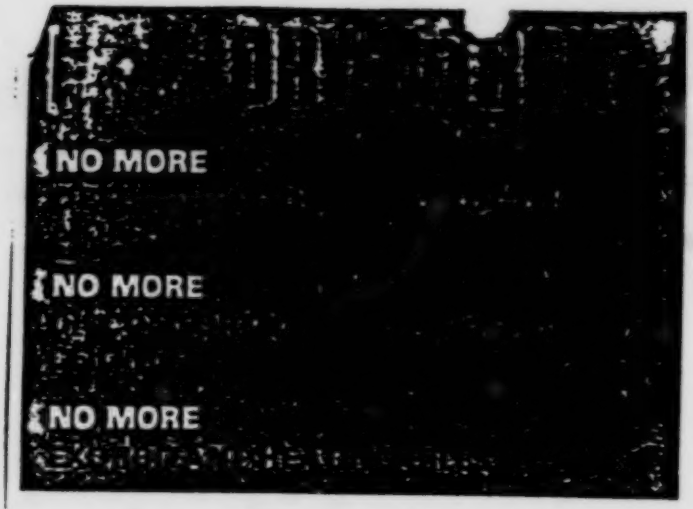
PARKLAND AGRIPLEX

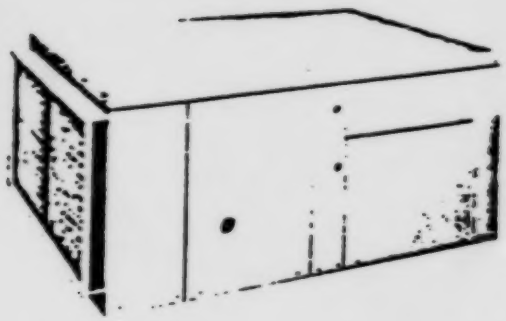
POOL

HIGH COST
(Mechanical Item 1)

The DRY-O-TRON heat pump will maintain an acceptable humidity level in your pool area. Utilizing a refrigeration process the DRY-O-TRON absorbs moist air and discharges dry air.

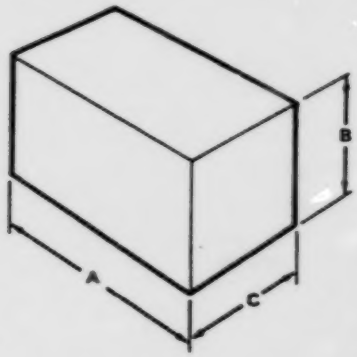
The unique DRY-O-TRON includes an energy saving heat recuperator. Every pint (0.5 L) of evaporated water removes approximately 1,000 BTU's (250 kcal) from the poolwater. A water surface of 100 sq. ft. (9.3 m2) evaporates approximately 2 quarts (2 L) of water per hour. Using a closed circuit heat loop, this highly efficient device catches the escaping energy and heats the pool water. All remaining energy is utilized to maintain the room temperature. A duct heater can be added to the DRY-O-TRON as a backup heater during cold weather periods to ensure adequate winter heating comfort. Under normal conditions energy savings of 60% to 80% are possible, as compared with conventional fresh air make-up humidity control systems.





Optional air condition converter using an outdoor air cooled condenser. This option provides year round pool comfort. A complete automatically controlled system is provided.

OVERALL DIMENSIONS



1.75 & 3.5 HP Models available in 230V, 1 ph only

PHYSICAL DATA FOR SWIMMING POOL 'DS' MODELS ONLY

DIMENSIONS	MODEL								
	VERTICAL	HORIZONTAL							
	DS 1	1.75 HP	2.5 HP	5 HP	7.5 HP	12 HP	20 HP	25 HP	35 HP
Width-A		48 1.22 m	51 1.30 m	56 1.42 m	55 1.40 m	55 1.40 m	90 2.29 m	90 2.29 m	100 2.54 m
Height-B		24 .61 m	25 .64 m	25 .64 m	42 1.07 m	42 1.07	45 1.14 m	50 1.27 m	66 1.68 m
Depth-C		25 .64 m	36 .91 m	43 1.09 m	36 .91 m	43 1.09 m	60 1.52 m	60 1.52 m	64 1.63 m
Drain		1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"
Weight		200 lb 91 kg	350 lb 159 kg	550 lb 249 kg	675 lb 306 kg	750 lb 340 kg	2 000 lb 907 kg	2 400 lb 1 089 kg	3 250 lb 1 474 kg

Above dimensions are approximate.
In the interest of product improvement, specifications and dimensions may be changed without notice.

Models for other applications are available

Contact your dealer or factory for further information.

Detailed technical brochure for DS model DRY-O-TRON available on request.

RECOMMENDED UNIT SIZE

Based on 81°F Air temperature, 80°F Water temperature 50% Humidity.

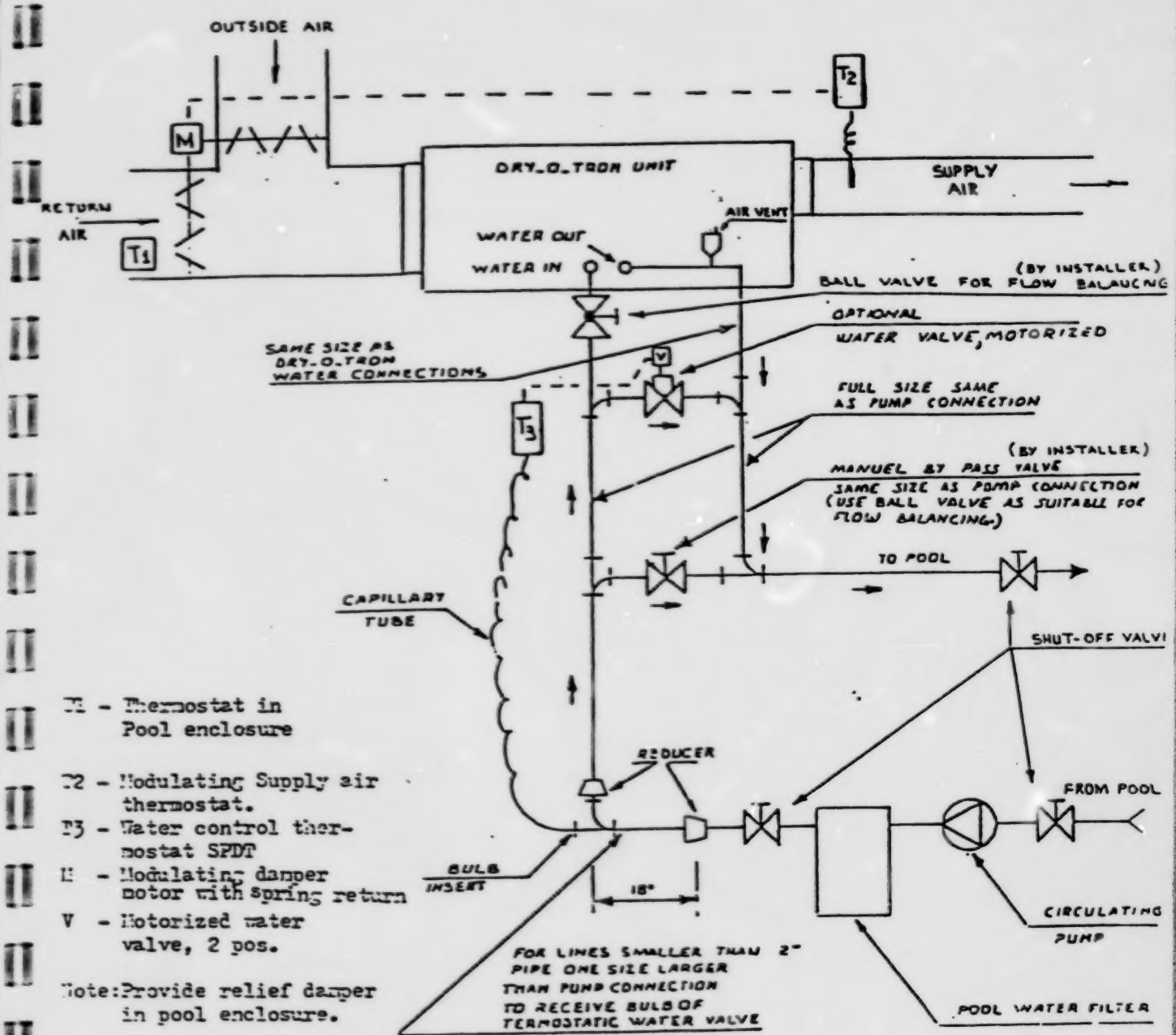
	DRY-O-TRON Model	POOLWATER SURFACE		
		Private Pool	Semi Private	Public
WHIRL POOLS	DS 1	50 Sq. Ft. 4.5 m²	50 Sq. Ft. 4.5 m²	40 Sq. Ft. 3.7
	DS 1.75	80 Sq. Ft. 7 m²	80 Sq. Ft. 7 m²	70 Sq. Ft. 6
SWIMMING POOLS	DS 1.75	290 Sq. Ft. 27 m²	220 Sq. Ft. 21 m²	145 Sq. Ft. 14 m²
	DS 3.5	640 Sq. Ft. 60 m²	480 Sq. Ft. 45 m²	320 Sq. Ft. 30 m²
	DS 5	980 Sq. Ft. 91 m²	735 Sq. Ft. 69 m²	490 Sq. Ft. 46
	DS 7.5	1 430 Sq. Ft. 133 m²	1 075 Sq. Ft. 100 m²	715 Sq. Ft. 67
	DS 12	2 700 Sq. Ft. 204 m²	1 650 Sq. Ft. 153 m²	1 100 Sq. Ft. 102 m²
	DS 20	2 860 Sq. Ft. 266 m²	2 150 Sq. Ft. 200 m²	1 430 Sq. Ft. 133 m²
	DS 25	3 600 Sq. Ft. 334 m²	2 700 Sq. Ft. 250 m²	1 800 Sq. Ft. 167 m²
	DS 35	5 720 Sq. Ft. 531 m²	4 290 Sq. Ft. 400 m²	2 860 Sq. Ft. 266

The use of a Photozone or Bromine water desinfection system is recommended to reduce the corrosive atmosphere to a minimum and to increase swimming comfort

DECTRON INC.

U.S.A.
217 South Union St.

CANADA
399 Deslauriers



T1 - Thermostat in Pool enclosure

T2 - Modulating Supply air thermostat.

T3 - Water control thermostat SPDT

M - Modulating damper motor with spring return

V - Motorized water valve, 2 pos.

Note: Provide relief damper in pool enclosure.

OUTSIDE AIR VENTILATION SYSTEM IN COMBINATION WITH DRY-O-TRON UNIT

Re: Technical Bulletin No. 3

B. MECHANICAL

POOL

NEW AND INNOVATIVE

1. Pool Make-Up Water:

Although this item is not directly energy related, we would suggest that the make up water for the pool be tied into the Water Treatment Plant being proposed for the Arena and Curling Area.

By using the treated water as make up for the pool the amount of chemical required to operate the pool and whirlpool will be reduced. This reduction in chemical amount and cost would quickly payback the cost of piping the treated water from the Arena Compressor Room to the pool make up water system. Also the size of the Water Treatment Plant would not be effected by the pool tie in. The cost of the piping involved should be less than $1,000.00.

2. Solar Heating:

The only Alternate Energy Source that comes to mind for this phase of the project is Solar.

Considering the installed cost of solar pool heating we cannot justify proposing this system. At present solar systems in this area are costing approximately $50/ft^2 of collector installed and each ft^2 of collector will collect approximately 200,000 BTU/year of solar energy. With gas prices at $3/MCF a solar system will not payback over any reasonable period of time, with a savings of only $1.00/ft^2 of collector/year.

A. ARCHITECTURAL

ARENA

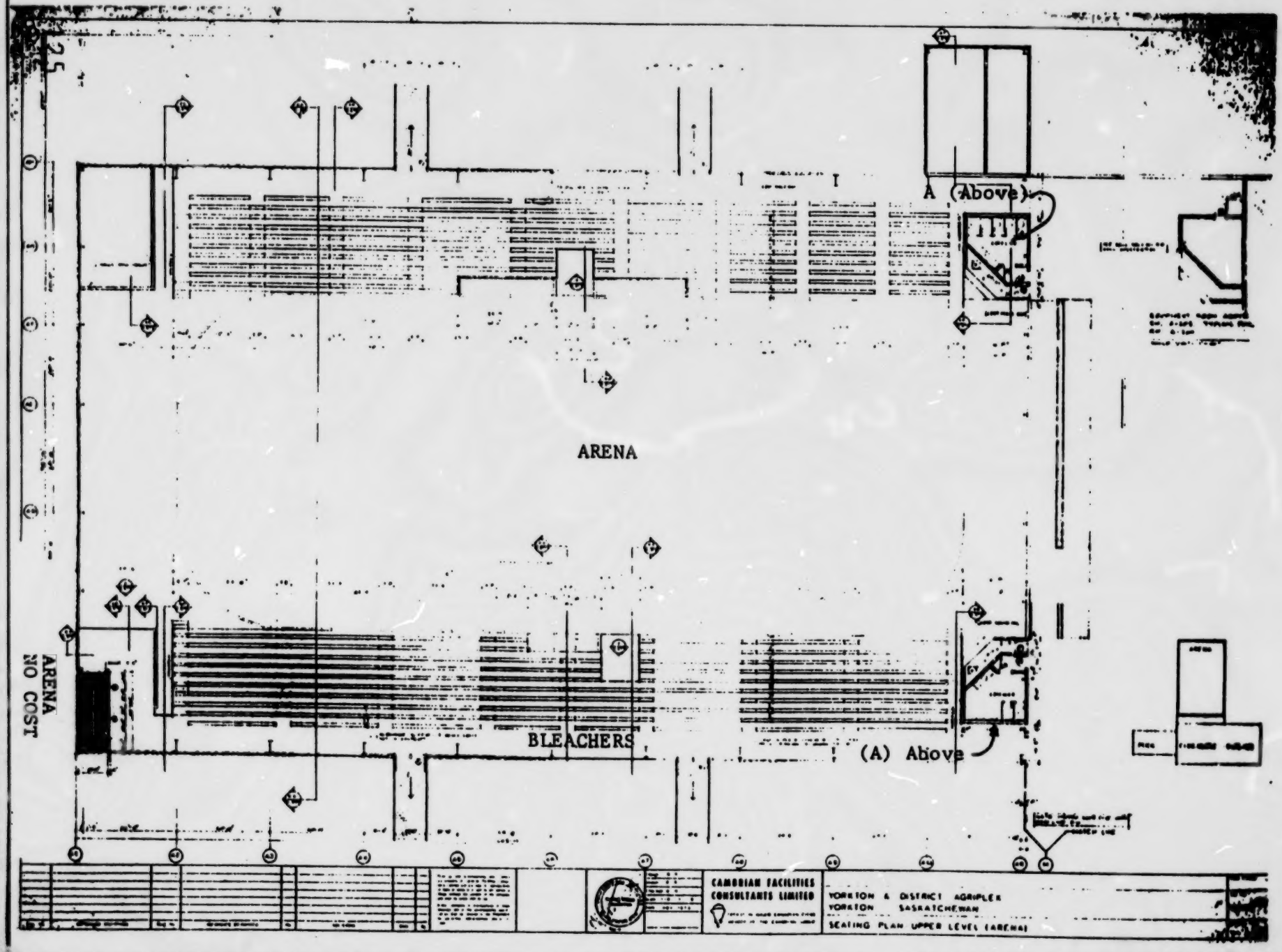
NO COST

1. The thermal scan of this area shows some anomalies at the exit doors. We would suggest that the exterior exits all be checked for weather tightness and repairs made where needed.

2. The exhausts penetrate the concrete block wall and as can be seen on photograph #23 there is some leakage around the housings and these should be checked and sealed to the block.

3. It is quite apparent from the thermal scan that a good deal of moisture is present in the concrete block walls at the shower and dressing room locations (see photographs 20, 21, 32, 24 and 25). As discussed previously (Pool) it is necessary to assure a good vapor barrier on the interior skin. We suggest that the dressing rooms, toilets and tractor room receive liquid applied vapor barrier (oil base paint or similar) on the exterior walls. This would involve two coats in tractor room and one additional coat elsewhere. The cost should not exceed $4,700.

4. Although it seems that the Arena heating units are a low-use item it should still be possible to clean the equipment filters. It appears that the filters have recently been removed because of inability to service this item properly. Access for maintenance would necessitate two additional access hatches (1½ hr. fire rated) to the equipment rooms. Their probably cost should not exceed $1,500. (A)


A (Above)
ARENA
BLEACHERS
(A) Above
ARENA
NO COST
CAMBRIAN FACILITIES
CONSULTANTS LIMITED
YORKTON & DISTRICT AGRIPLEX
YORKTON SASKATCHEWAN
SEATING PLAN UPPER LEVEL (ARENA)

B. MECHANICAL

ARENA

NO COST

1. Melt-Pit:

The melt-pit located in the floor of the tractor room stores the ice and snow removed from the arena ice surface. Domestic hot water is then used to melt the ice and the remaining water is drained into the sewer system.

We would suggest that this practice be discontinued, we propose that all the ice and snow removed from the ice surface be dumped on the open area to the north of the Agriplex Building and simply be allowed to melt in the spring of the year.

Some rink operators that have started this practice have found it necessary to add a vestibule and second door to the tractor exit in order to cut down on infiltration and heat loss during the movement of the snow to the outdoors.

We feel that this addition may not be warranted in light of the fact that the temperature within the space is normally kept at a level less than room temperature.

2. Entrance Way Heating:

At present the entrance way vestibules are open to the Arena Area and are complete with electric fan coil units. Due to the fact that the Arena is normally not heated the electric heat runs continuously during the entire heating season.

We would propose that all the electric heating units located at outside doors serving the Arena be turned off.

The only capital cost involved in this proposal is that the domestic water lines running through the vestibules in question must be insulated and must be complete with electric heat tape.

The total cost to do the required work in the four areas should be less than $2,000.

Assuming that each of the four electric heaters involved are approximately 6 kW, the payback period during the heating season would be approximately 3 months, calculated as follows:

4 heaters x 6 kW x 4¢/KWH x 24 hrs/day
divided into the capital cost of $2,000
= 83 days or approximately 3 months

3. Change Room Exhaust Fan Control:

The existing nine (9) exhaust fans located in the various change rooms are controlled from manual switches located in a central area.

In order to make this aspect of the operation automatic, we would suggest the addition of a time clock to switch the fans.

The cost of this proposal would be approximately $300 and would eliminate any chance of the fans being operated when not required. With nine (9) exhaust fans running at an average of 300 cfm each the total air flow would be 2,700 cfm.

The cost to heat the replacement air would be approximately $3/cfm per year if the electric heating system is to remain as installed.

If the proposed time clock could reduce the exhaust fan operation by only 10% the payback would be: 10% x $3/cfm x 2,7000 cfm = $810.00/year. With the capital cost of the time clock at $300 the simple payback period would be approximately 4 months.

4. Change Room Heating/Night Set-Back:

At present the change rooms along both sides of the area are heated electrically. The power supply to the heaters is turned on at the start of the heating season in the fall and turned off in the spring.

Due to the fact that the change rooms are now not insulated from the remainder of the Arena Area, the heating in the change rooms operates almost continuously.

We would propose the addition of a time clock and night set back temperature control during unoccupied hours in the change rooms, the temperature would be allowed to drop to approximately 40°F. The cost of this addition would be approximately $500 and the pay-back period would be less than one heating season.

5. Antistratification Fans:

During occupied times in the Arena Area and when the main heating system is in operation, we feel that energy could be saved if the higher temperature air located at the ceiling of the building could be brought down to grade or seating level.

In order to do this we would propose the addition of eight ceiling mounted antistratification fans (see attached information sheets). We would suggest using the 60" diameter units complete with variable speed and reversible direction motors. Over the seating and ice area it is important that the air velocity be controlled as not to create draft problems or problems with the ice surface.

The cost to supply and install these eight fans would be approximately $4,000. In a normal application the energy saved by the effect of the fans would payback the installed cost in 2 or 3 years.

However, in this case, due to the fact that the space is not heated on a regular basis it would be impossible to calculate actual energy saving. We would however suggest that this proposal would be a good investment.

6. Change Room Infiltration:

Each of the perimeter change rooms is complete with a wall type exhaust fan and during times when the fans are not operating the standard backdraft dampers allow infiltration.

Although it is hard to calculate the actual amount of outside air entering the space during certain wind conditions the amount could be significant.

In order to keep infiltration to a minimum, we would suggest the addition of "No Leak" dampers on each exhaust fan outlet. (See attached information brochures.)

The proposed damper would be normally closed and would open only during fan operation.

Each damper would cost approximately $250 plus installation and controls at an additional $150 for a total installed cost per damper of $400.

In the Arena Area the number of fans involved is nine giving us a total installed cost of $3,600.

The area involved with the infiltration through the fan openings is presently heated electrically and we have estimated the payback period on the installation of the dampers as follows:

The total exhaust capacity of the system is 2,700 cfm. Using a 20% leakage factor when the fans are shut down (assuming 40% of the time) and electrical energy at 4¢/KWH the cost savings would be:

$$\frac{20}{100} \times 2{,}700 \times \frac{60}{100} \times \$3/\text{cfm/year} = \$972/\text{year}$$

With the capital cost of the damper installation at $3,600, the simple payback would be approximately 4 years.

PARKLAND AGRIPLEX
ARENA

NO COST
(Mechancial Item 5)

A fan for all reasons

industrial • commercial • reside
institutional • agricultural • ind
36F
residential • commercial • inst
strial • agricultural • residenti
al • institutional • agricultural •
FR52
• reside industrial • instit
mercial • agricultural • reside
ndustrial • commercial • agricu
residential • industrial • comm
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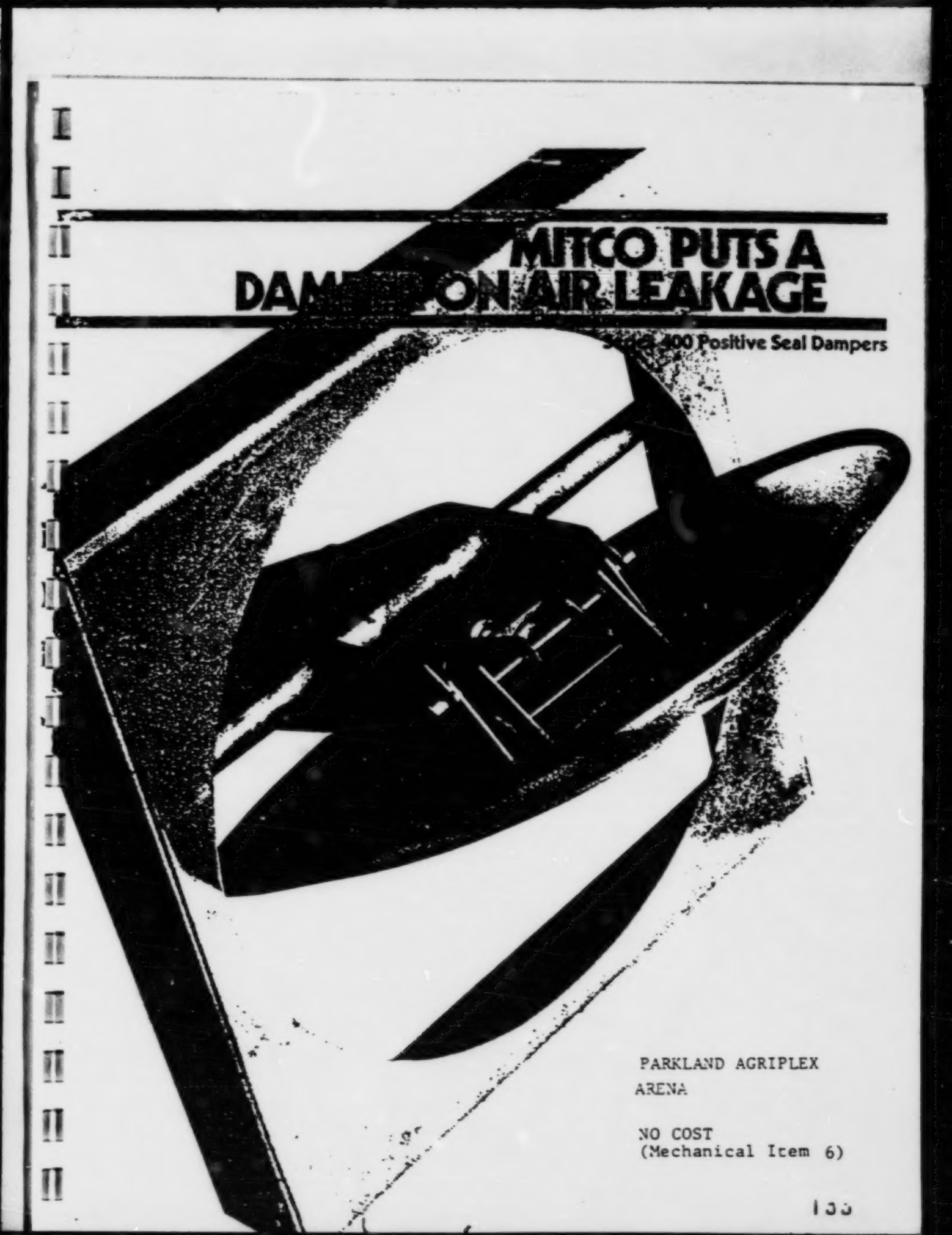
60F
tutional • agricultural • residen

Ceiling Fan Systems by WILCORP



PARKLAND AGRIPLEX
ARENA

NO COST
(Mechanical Item 6)

C. ELECTRICAL

ARENA

Generally the existing light levels are adequate.

General Area:

.1 Install additional switches to permit shutting off lights in unoccupied areas of the building.

.2 Modify existing luminaires to accommodate higher efficiency lamps; for instance, convert incandescent lamp luminaires to high intensity discharge (HID lamps) or convert existing HID lamps to newer or more efficient ones.

.3 Replace incandescent luminaires with more efficient fluorescent or high pressure sodium fixtures.

.4 Replace all incandescent fixtures (101) with fluorescent units. (51)

Cost Comparison:

Energy - 101 x .150 x .0186 x 2390 hour = $ 673.48

Demand - 101 x .150 x $6.65 x 12 months = 1,208.97

$1,882.45

Annual Energy Billing + 10% surcharge + 5% E & H Tax = $2,174.23

Lamps - $101 \times \frac{2390}{1500} \times \$1.60 =$ 257.48

Lamp Labour - $101 \times \frac{2390 \text{ hour}}{1500 \text{ hour}} \times \frac{.1 \text{ hour}}{\text{lamp}}$

$\times \$15.00 =$ 241.39

Total Annual Incandescent Cost = $2,673.10

Replace with 51 Fluorescent units:

Energy - .095 KW x 51 x $.0186 x 2390 =	$215.38
Demand - .095 KW x 51 x $6.65 x 12 months=	$386.63
	$602.01
Annual Energy Billing + 10% surcharge + 5% E & H Tax =	$695.32
Annual Lamp Replacements - $.50 x 2 x 51=	$ 51.00
	$746.32

Annual Savings = $2,673.10 - $746.32 = $1,926.77

Cost to remove incandescent and replace with vandal-proof fluorescent = 51 x 100 - $5,100.00

Payback = $\frac{\$5,100.00}{\$1,926.77}$ = 2.65 years

ICE AREA

All 48 of the 347 volt, 1000 watt mercury fixtures should be changed to 400 watt high pressure sodium fixtures. Lumen output is approximately the same with a change to a golden color.

Cost Comparison:

Mercury Cost -

Energy - 48 fixtures x 1.100 KW x $.0186 x 2390 hour = $2,347.17

Demand - 48 fixtures x 1.10 KW x $6.65 x 12 months = 4,213.44

$6,560.61

Annual Energy Billing + 10% surcharge + 5% E & H Tax = $7,577.50

Lamp replacement costs for mercury and sodium fixtures are approximately the same, therefore calculation not required.

Sodium Cost -

Energy - 48 fixtures x .480 KW x .0186 x 2390 hour = $1,024.22

Demand - 48 fixtures x .480 KW 1 $6.65 x 12 months = 1,838.59

$2,862.81

Annual Energy Billing + 10% surcharge + 5% E & H Tax = 3,306.55

Annual Savings - Sodium versus Mercury = $7,577.50 - $3,306.55 = $4,270.95

Replacement cost - approximately $12,000.00

Payback period = $\frac{\$12,000.00}{\$4,270.00}$ = 2.8 years.

A. ARCHITECTURAL

ARENA

HIGH COST

Since the energy consumption is mainly electrical and since the dressing and change rooms and exit lobbys are electrically heated, it would seem logical to isolate this heating from the main rink area where the requirement is really of an opposite nature. The compressor expends energy to keep the ice frozen and the electrical heating units are counter-acting this by spilling heat into the main ice arena. It would seem therefore logical to separate the "heated" area from the basically "unheated" area.

We would therefore suggest a major change to this area.

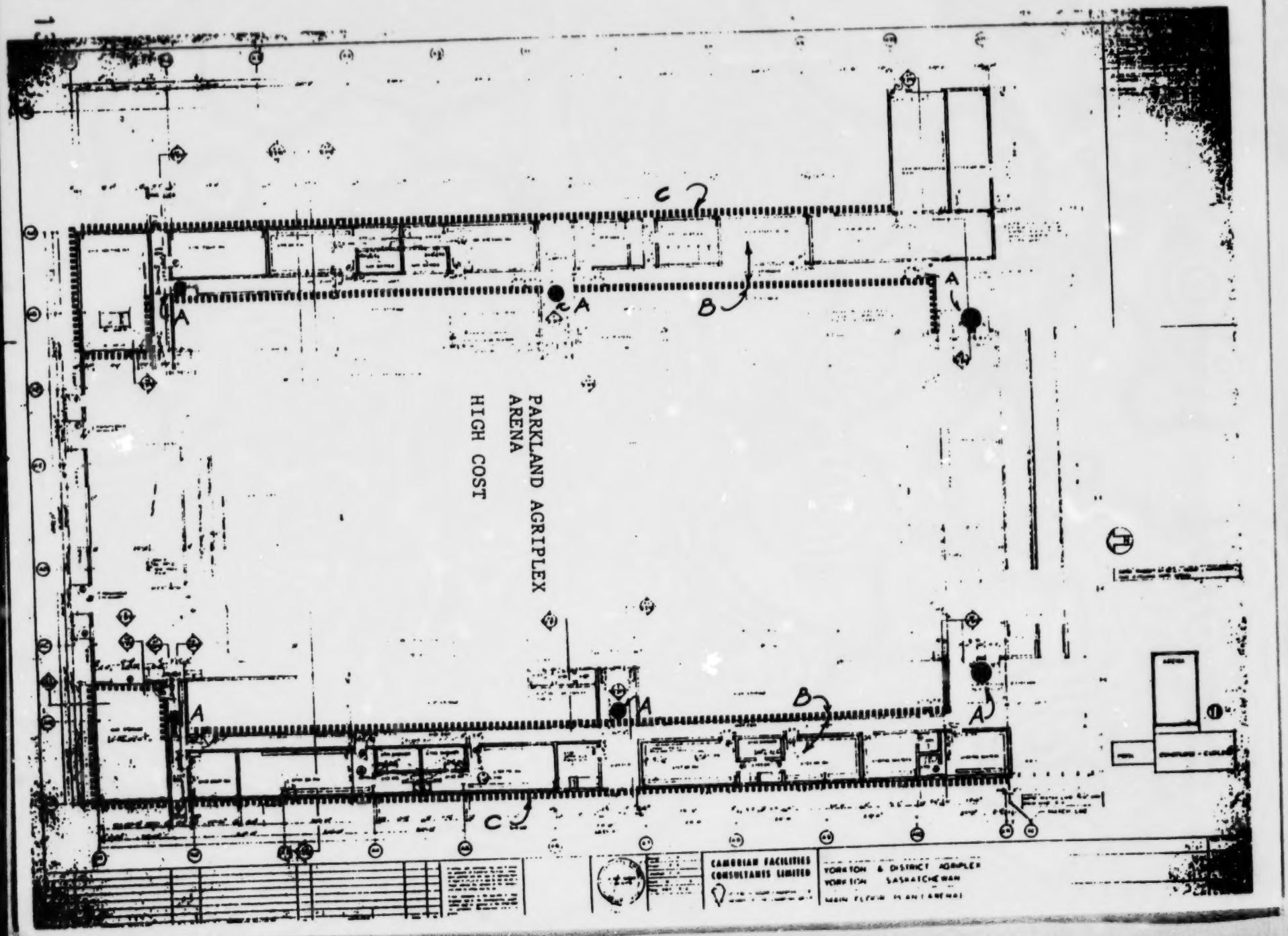
We propose the installation of exit doors at the centre aisle and ends of corridors (A in plan) as well as insulation to the underside of bleachers, walkway (B) and exterior of dressing room areas (C). (See attached floor plan and details).

The cost of these renovations is expected to be in the order of $47,200. This cost can be broken down as follows:

a) application of 2" rigid insulation and ½" plasterboard to the interior walls, underside of concrete deck and stands as well as doors and frames should not exceed $22,000. Based on an average Arena temperature of 40°F, an annual saving of 2,029,000 MBTU or $23,365 can be realized, which indicates a payback time of less than one year.

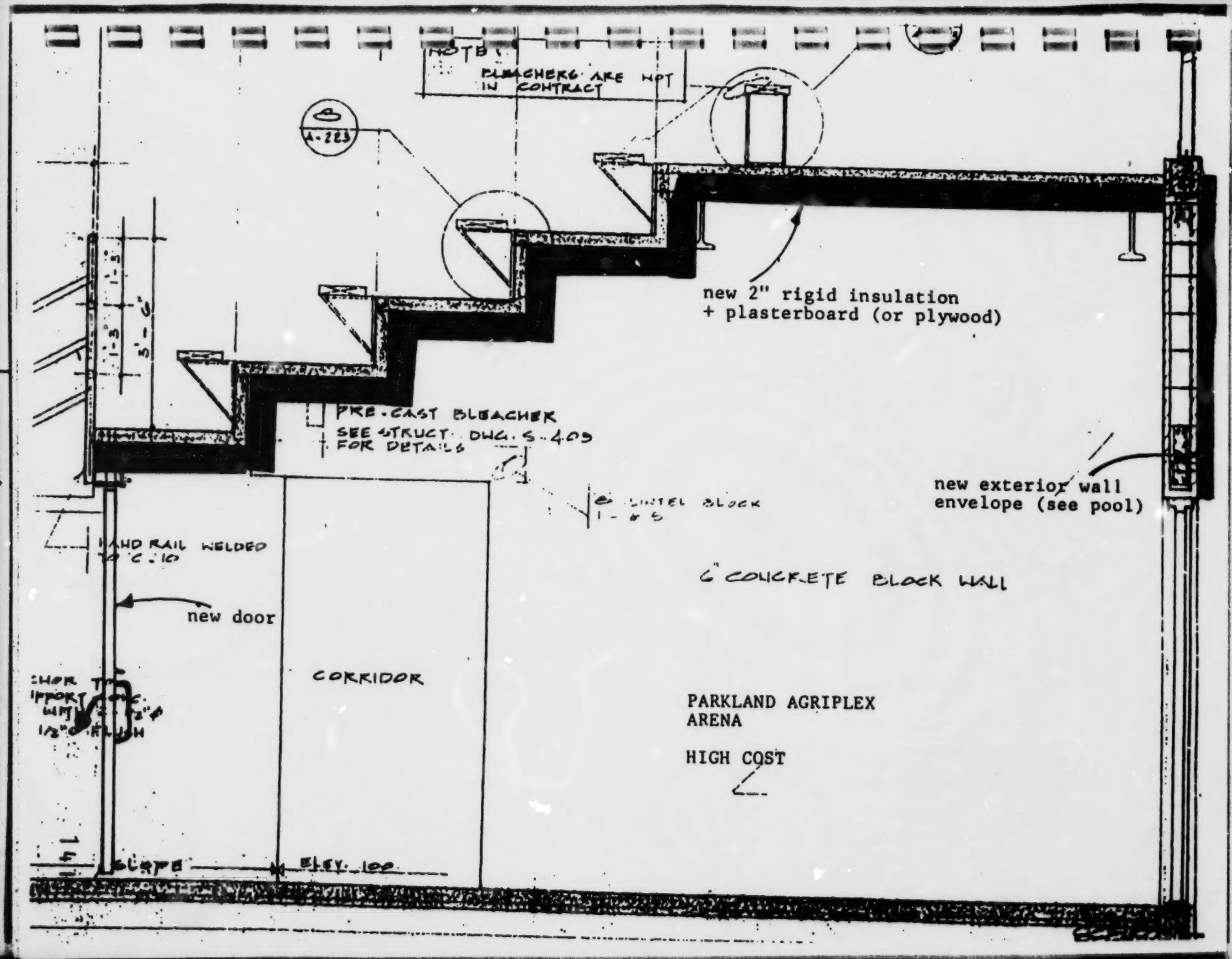
b) exterior concrete block walls insulated with 2" rigid insulation and stucco should not exceed $25,200. This could save 630,000 MBTU/year or $7,901 annually, which would represent a payback of approximately 3.2 years.

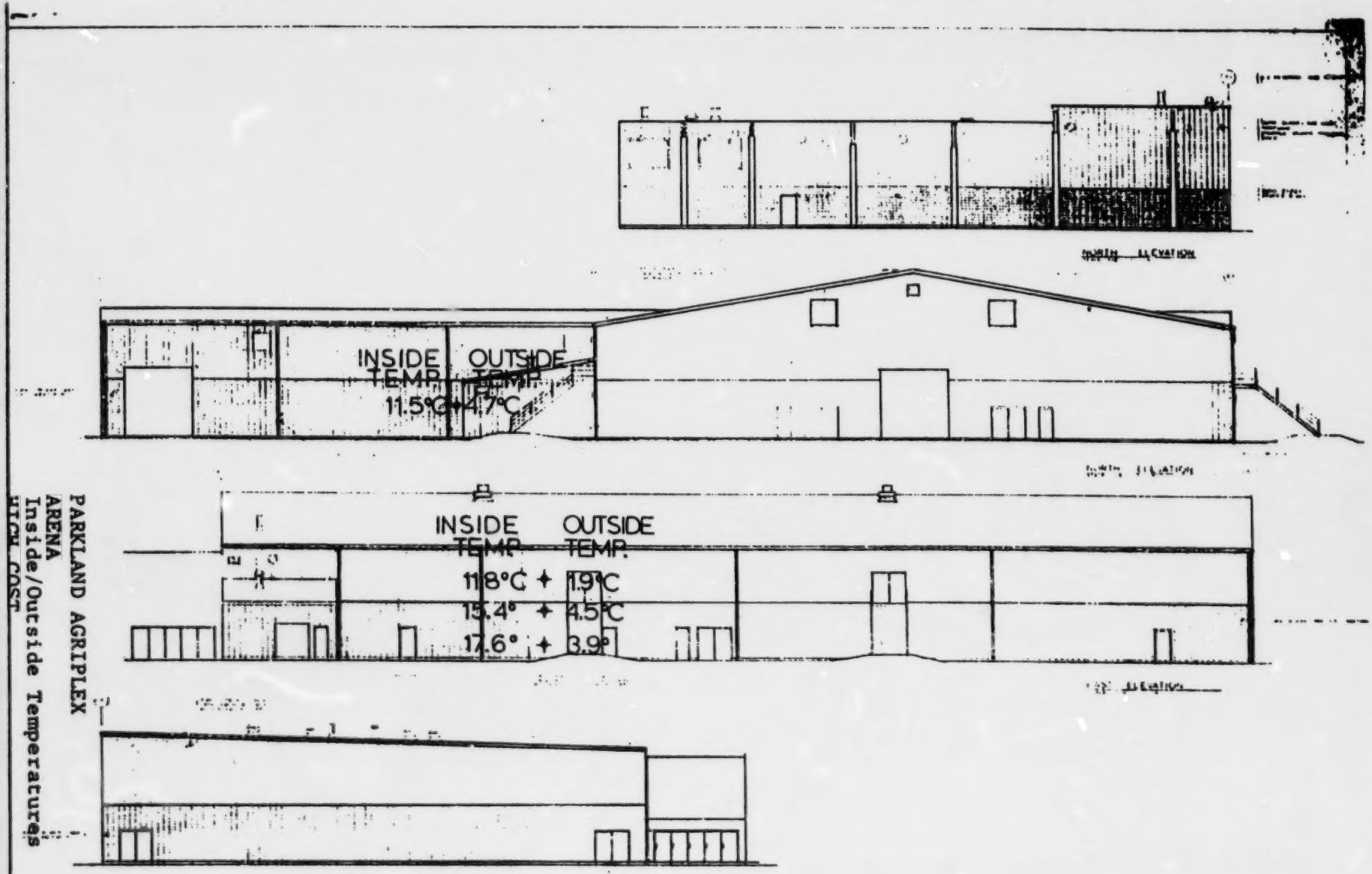
The above is based on the retention of the electrical system as currently exists, however if the system is switched to gas based energy the savings would be $34,945 total.


PARKLAND AGRIPLEX
ARENA
HIGH COST
CAMROSIAN FACILITIES CONSULTANTS LIMITED
YORKTON & DISTRICT AGRIPLEX
YORKTON SASKATCHEWAN

PARKLAND AGRIPLEX
ARENA

HIGH COST


HOT B
BLEACHERS ARE NOT IN CONTRACT
A-223
new 2" rigid insulation
+ plasterboard (or plywood)
PRE-CAST BLEACHER
SEE STRUCT. DWG. S-405
FOR DETAILS
LINTEL BLOCK
new exterior wall
envelope (see pool)
HAND RAIL WELDED
6" CONCRETE BLOCK WALL
new door
CORRIDOR
PARKLAND AGRIPLEX
ARENA
HIGH COST
SLOPE
ELEV. 100



PARKLAND AGRIPLEX
ARENA
Inside/Outside Temperatures
HIGH COST

CAMBRIAN FACILITIES CONSULTANTS LIMITED

[PARKLAND AGRIPLEX ARENA DRESSING ROOMS]

INSULATION PROGRAM

MOST INDUSTRIAL AND COMMERCIAL BUILDINGS ARE POORLY INSULATED.

THIS RESULTS IN OVERSIZED HEATING PLANTS, WASTAGE OF HEATING FUELS, AND EMPLOYEE DISCOMFORT.

THIS PROGRAM WILL SHOW HOW MUCH HEAT CAN BE SAVED BY APPLICATION OF ADEQUATE INSULATION TO THE ROOF, WALLS, WINDOWS, AND OUTSIDE GROUND WALL EDGE. IT WILL ALSO INDICATE THE EFFECT OF THERMOSTAT SET-BACK ON ENERGY CONSUMPTION.

FOR THE PURPOSE OF THIS DEMONSTRATION WE WILL ASSUME TRANSMISSION HEAT LOSS ONLY.

INPUT THE FOLLOWING DATA (EXISTING CONDITIONS ONLY):

1) PLANT LENGTH (FT)
   (IF UNKNOWN, ENTER ZERO)? 1000
2) PLANT WIDTH (FT)? 13.8
3) PLANT HEIGHT (FT)? 7.1
4) DAYS IN HEATING SEASON ? 241
5) DEGREE DAYS (BASED ON 65 DEG F)? 11410
6) R-FACTOR OF ROOF (SQ FT.HR.DEG F/BTU)? 1.775
7) R-FACTOR OF WALLS (SQ FT.HR.DEG F/BTU)? 4.55
8) WINDOW AREA (%)? 0
9) NO WINDOWS.
10) SLAB EDGE HEAT LOSS PER LINEAR FOOT (BTU/HR/FT)
    (NO INSULATION = 50.0000, R6 INSULATION = 25.0000)? 0
11) TEMPERATURE INSIDE THE PLANT (DEG F)? 70
12) HOURS PER WEEK AT THIS TEMPERATURE? 168
13) NO SET-BACK.
14) STRATIFICATION TEMPERATURE DIFFERENCE (DEG F)? 0
15) INTERNAL HEAT GAIN (%) ? 5
16) TYPE OF FUEL ? ELECTRICITY
17) COST OF FUEL IN DOLLARS PER KWH ? .04
18) HEATING PLANT EFFICIENCY (%) ? 100

INSULATION PROGRAM (CONTINUED)

EXTERIOR SECTION	ENERGY USAGE (MBTU/YEAR)	PRESENT COST ($/YEAR)
ROOF	2,236,160	$26,200
WALLS	910,021	$10,662
WINDOWS	0	$0
SLAB EDGE	0	$0
TOTAL	3,146,180	$36,862

INSULATION PROGRAM (CONTINUED)

MODIFICATIONS:

7) R-FACTOR OF WALLS (SQ FT.HR.DEG F/BTU)? 17.57

EXTERIOR SECTION	ENERGY USAGE (MBTU/YEAR)	($/YEAR)	SAVINGS (MBTU/YEAR)	($/YEAR)
ROOF	2,236,160	$26,200	0	$0
WALLS	235,663	$2,761	674,358	$7,901
WINDOWS	0	$0	0	$0
SLAB EDGE	0	$0	0	$0
TOTAL	2,471,820	$28,961	674,358	$7,901

TRACKLAND ACRIPLEX ARENA DRESSING ROOMS]

INSULATION PROGRAM (CONTINUED)

MODIFICATIONS:

6) R-FACTOR OF ROOF (SQ FT.HR.DEG F/BTU)? 16.407

EXTERIOR SECTION	ENERGY USAGE (MBTU/YEAR)	($/YEAR)	SAVINGS (MBTU/YEAR)	($/YEAR)
ROOF	241,920	$2,834	1,994,240	$23,365
WALLS	910,021	$10,662	0	$0
WINDOWS	0	$0	0	$0
SLAB EDGE	0	$0	0	$0
TOTAL	1,151,940	$13,497	1,994,240	$23,365

INSULATION PROGRAM (CONTINUED)

MODIFICATIONS:

16) TYPE OF FUEL ? NATURAL GAS
17) COST OF FUEL IN DOLLARS PER MCF ? 3.01
18) HEATING PLANT EFFICIENCY (%) ? 75

EXTERIOR SECTION	ENERGY USAGE (MBTU/YEAR)	($/YEAR)	SAVINGS (MBTU/YEAR)	($/YEAR
ROOF	2,981,550	$8,974	-745,386	$17,225
WALLS	1,213,360	$3,652	-303,340	$7,010
WINDOWS	0	$0	0	$0
SLAB EDGE	0	$0	0	$0
TOTAL	4,194,910	$12,627	-1,048,730	$24,235

[FORTYLAND AGRIPLEX ARENA DRESSING ROOMS]

INSULATION PROGRAM (CONTINUED)

MODIFICATIONS:

6) R-FACTOR OF ROOF (SQ FT.HR.DEG F/BTU)? 16.407
7) R-FACTOR OF WALLS (SQ FT.HR.DEG F/BTU)? 17.57
16) TYPE OF FUEL ? NATURAL GAS
17) COST OF FUEL IN DOLLARS PER MCF ? 3.01
18) HEATING PLANT EFFICIENCY (%) ? 75

EXTERIOR SECTION	ENERGY USAGE (MBTU/YEAR)	($/YEAR)	SAVINGS (MBTU/YEAR)	($/YEAR)
ROOF	322,560	$971	1,913,600	$25,229
WALLS	314,217	$946	595,804	$9,716
WINDOWS	0	$0	0	$0
SLAB EDGE	0	$0	0	$0
TOTAL	636,777	$1,917	2,509,410	$34,945

B. MECHANICAL

ARENA

NEW AND INNOVATIVE

1. Water Treatment:

The water used to make ice and to maintain the ice in both the Arena Area and the Curling Rink is standard City of Yorkton domestic tap water.

In an effort to cut operating cost including refrigeration compressors run time and the amount of flooding required and in order to produce a harder, faster ice with less snow produced, we propose the installation of a Water Treatment Plant. (See attached product information sheet.) All water used in the making and flooding of both ice surfaces would be treated by the "JET ICE" water treatment equipment. As an added bonus the make-up water used in the swimming pool would also be treated (see Pool Section of this Report).

The total cost of the supply and installation of the "JET ICE" water treatment equipment would be $29,000, with the cost being split $7,000 for the Curling Rink and $22,000 for the Arena Area.

The equipment supplier has been given the details of the Yorkton water composition and he has indicated that with the savings realized in the reduced power consumption by the refrigeration compressors the capital cost of the Water Treatment Equipment ($29,000) would be paid back in approximately four years of normal operation.

In addition to the energy saved the life of the refrigeration equipment would be extended and the ice maintenance would be reduced making this proposal an excellent investment.

One cost that we have not included in the installation of this equipment is the floor space required to house the equipment.

During a site inspection, we felt that all available space in the area of the water heating room and refrigeration room was being utilized.

We therefore would suggest the addition of a Water Treatment and Heat Reclaim Room against the north side of the existing Refrigeration Room. The room would be approximately 14' wide by 24' long at a cost to construct of $\$35/ft^2$ = \$12,000.

The proposed room would be shared by the proposed Water Treatment Equipment and the proposed Heat Reclaim Equipment.

If 50% of the space cost was added to the cost of the Water Treatment Plant it would increase the payback period by one year to five years total.

2. <u>Heat Reclaim</u>:

The existing ice making equipment consists of 2 x 60 ton ammonia compressors driven by two 75 HP electric motors.

The heat rejected by the two compressors is handled by an air cooled evaporative condenser located just north of the compressor room.

We would propose that the waste heat from the compressors be reused within the building rather than being discharged to the outdoors by the condenser unit.

The condenser would be kept on stream to handle the required heat rejection in cases where the building could not use the total heat available.

With both compressors in operation (2 x 60 ton units) the total heat available would be approximately 2 x 60 tons x 12,000 BTU/ton x 1.25 (ammonia gas is superheated approximately 25% during the compression phase of the refrigeration cycle) = 1,800,000 BTU/hour.

Due to the nature of the ammonia compressors the 1,800 MBH cannot all be taken off as high quality heat. The heat reclaim system would be split into two separate heat exchangers, one for the high quality heat (approximately 180^{o}F) and the second for the low quality heat (approximately 100^{o}F).

With both compressors running at full load we would suggest that the high quality heat available would be 10% to 20% of the total.

We have chosen two "THERMAL STORE" Heat Exchangers for this task, (see attached product information sheets), each with a capacity of 100,000 BTU/hr each. The high quality domestic water being produced would be used for ice flooding, showers, and general domestic hot water used throughout the complex.

The remaining low quality heat would be reclaimed by a special Cupernickel Heat Exchanger and would be used to heat the swimming pool water, the curling rink space, the change rooms in the Arena Area and finally the Arena Space.

The existing heating equipment serving each of the aforementioned areas would be retained and used as backup to the new system being supplied with reclaimed heat.

The cost of the required heat exchangers supplied and installed complete with 50% of the cost of the room construction (area being shared with proposed water treatment equipment) will be approximately $55,000. To tie in the heat reclaim system to the pool water, the curling rink, the arena change rooms and the arena space heating system will cost an additional $30,000 for a total installed cost of $85,000.

Considering the fact that the pool water, the domestic water and the arena space heating are presently heated with natural gas and the curling area and the change rooms are heated electrically the energy savings would amount to over $10/hr during the heating season with both compressors in operation. The $10/hr figure was calculated as follows:

$$\frac{1{,}800{,}000 \text{ BTU/hour}}{1{,}000 \text{ BTU/Ft}^3\text{gas} \times 1{,}000 \text{ Ft}^3\text{/MCF} \times 70\% \text{ eff. of existing}}$$

gas fired equipment = 2.57 MCF savings x $3/MCF = $7.71/hr savings.

The figure of $7.71 represents the energy savings if all energy consumption being replaced was natural gas. However, a substantial amount is in fact electrical. We have therefore increased the $7.71 figure to $10.00/hour for this reason.

In accordance with a recent Province of Saskatchewan Mobile Energy Audit done of this building as conducted by Energy Audit Engineer Dave Pollock, the compressors run on an average of 40 hour/week at "full load" for an average of 32 weeks of the year. The remaining time only one unit is in operation.

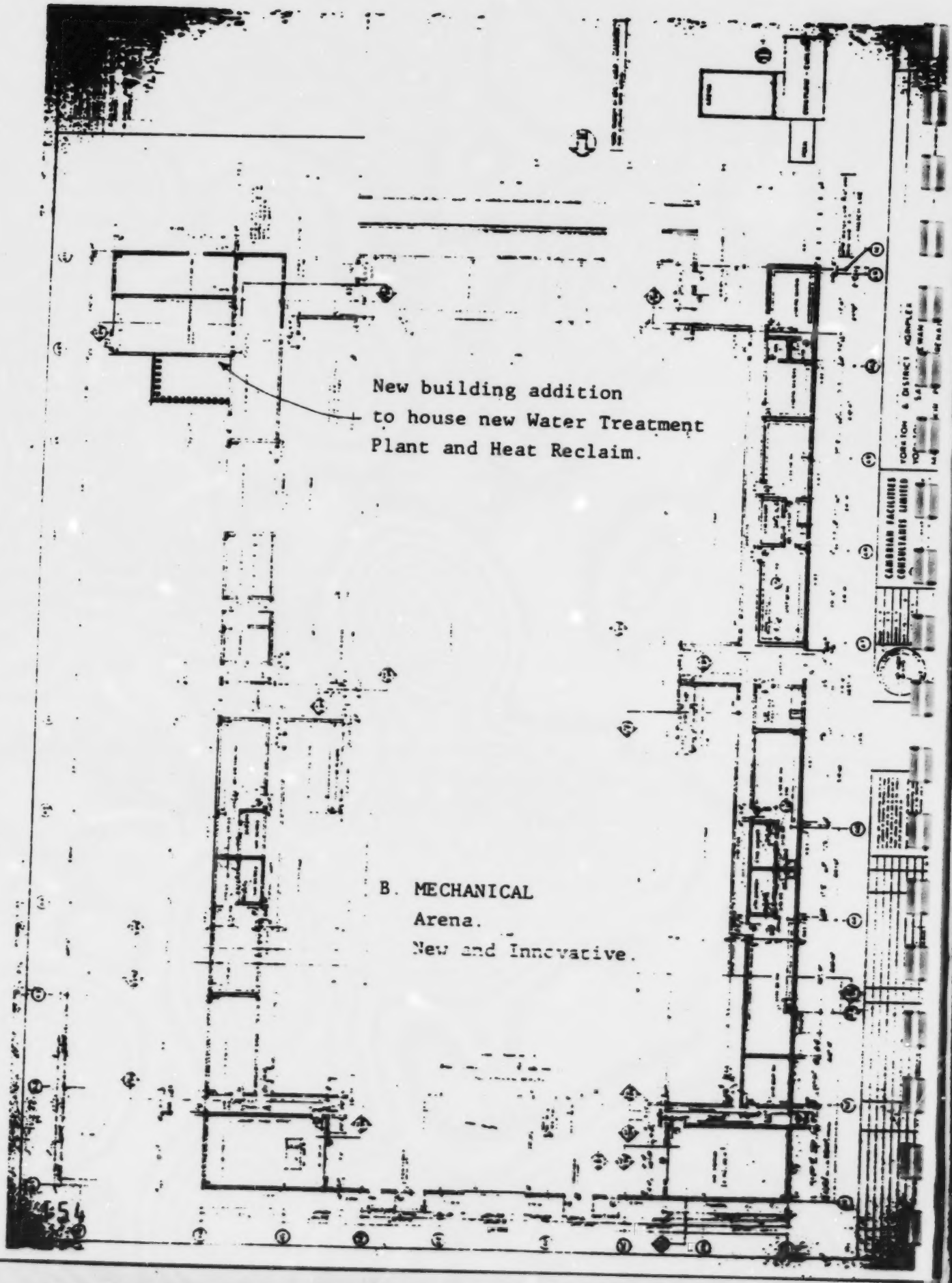
Assuming this information to be correct the actual savings on a yearly basis using the heat reclaim system would be:

40 hours/week at full load = 40 x 10 = $400
128 hours/week at 50% load (one compressor) =
128 x 5 = $640.

For a total of $1,040/week potential energy savings. Using a 32 week year the total yearly savings amounts to $33,280/year, which would indicate a simple payback period of approximately 3 years assuming 100% of the waste heat being supplied by the refrigeration equipment could be used in the remainder of the building.

We feel that this may not always be the case and would recommend that a more realistic payback period would be four years.

Although the capital cost of this item is high, we would strongly recommend that this proposal receive serious consideration, in that, it has the potential for a large amount of energy conservation.


New building addition
to house new Water Treatment
Plant and Heat Reclaim.
B. MECHANICAL
Arena.
New and Innovative.

WHAT IS JET ICE?

JET ICE is high speed QUALITY ice — the ice of the eighties. **JET ICE** is ideally suited to the game of hockey and has been widely endorsed by stars of the NHL. Many players say it reminds them of the good ice surface of their youth.

JET ICE — a product of extensive research and chemical engineering — brings out the best in an individual or a team.

THE SECRET IS WATER QUALITY AND PROPER APPLICATION

JET ICE is superior to ordinary artificial ice because of a new process that brings out the best performance of water used for ice making. An ice surface is only as good as the quality of the water that goes into it. An ideal frozen surface is made from clean mineral free water. For years, professional ice makers have been frustrated in their quest for an ideal ice surface. Now **JET ICE** offers the perfect solution. **JET ICE** achieves complete water demineralization through the use of ion exchange equipment installed near the ice making plant in the arena.

Then **JET ICE** goes a step beyond. The water, now demineralized, is further purified to remove any trace contaminants which are still susceptible to ion exchange treatment. The water is then heated and as this water is pressed into the Zamboni for resurfacing, a chemical additive is employed which further reduces dissolved air and gases. The ice surface a beautiful glossy appearance.

The result? A hard durable sheet of ice which brings instant approval from the athlete, whether he be amateur or pro hockey player or figure skater.

HISTORY OF JET ICE

While experiments to improve ice conditions in major arenas have been ongoing for years, **JET ICE** is a recent innovation. **JET ICE** was developed in 1979 through the combined efforts of Maple Leaf Gardens Chief Engineer Doug Moore and research chemist Cal Adamson, both of Toronto. For several seasons, Moore's objective was to improve the ice-making system at the Gardens. Adamson's role was to experiment with a new water demineralization process using the Gardens' ice-making facilities as his lab. Ultimately, these experiments produced a near-perfect quality of water, which, when frozen, became — **JET ICE**.

AN OPEN INVITATION TO ALL ARENA OPERATORS TO INSPECT A NEW JET ICE INSTALLATION

Come and See for Yourself

*Magic potion: Doug Moore is the man responsible for the ice at Maple Leaf Gardens and, under his care, the ice surface has gone from ranking as one of the worst in the National Hockey League to one of the best. One of Moore's secret ingredients is pure water.

*Courtesy of the Toronto Star

BENEFITS OF JET ICE TO THE ARENA OPERATOR

Due to the durability of **JET ICE**, it does not cut up as readily and much less snow accumulates on the surface, therefore, considerably less water is required for resurfacing. As demineralized water freezes significantly faster than raw water, less refrigeration is required to dry and maintain floods. This results in not only a saving in power and water, but in the upkeep of the Zamboni, less blade sharpening, less flooding, a saving in manpower and operating costs, thus enabling the arena to utilize its ice time more profitably, and give the skating public a much better product for their money.

Other benefits of **JET ICE** are obvious. Faster play, more confident, improved performances, less risk of injury, fewer delays for minor ice repairs. In short — **JET ICE** provides an ideal showcase for athletic skills and talent.

THE MICHIGAN TECH INSTALLATION

During the 1979-80 hockey season, Moore and Adamson were invited to Houghton, Michigan to supervise the installation of **JET ICE** in the home of the renowned Michigan Tech Huskies. Arena manager Bob Hauswirth, the Huskie coaching staff and players were elated with the quality of the ice and its durability. Their praise has brought enquiries from many other American colleges across the United States.

ENDORSEMENTS

Professional hockey players and coaches have been lavish in their praise of **JET ICE**.

Since the development of **JET ICE**, many privately owned, community owned, Universities and National Hockey League arenas as well as Curling Clubs are making preparations for the installation of **JET ICE**.

Two recent hockey personalities of the Toronto Maple Leaf organization, Lanny McDonald and Roger Neilson endorse **JET ICE** through the marked improvement in quality and durability of the ice in Maple Leaf Gardens, withstanding tremendous heat loads on an original floor and piping of 49 years.

THERMA-STOR® III

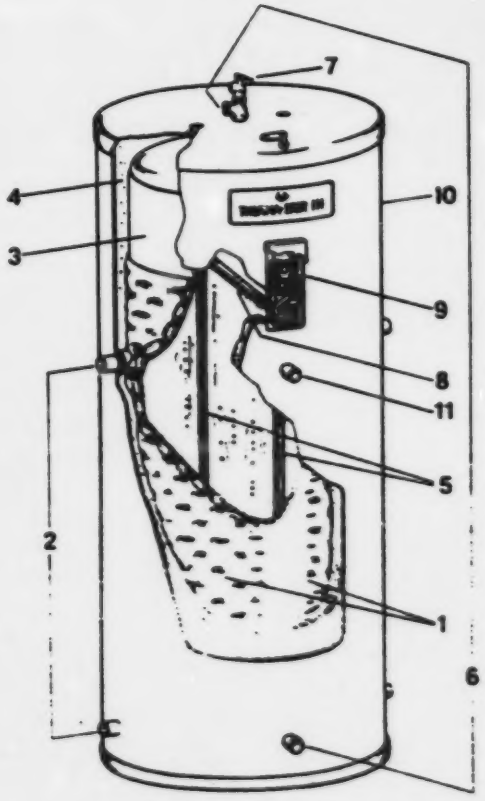
Heat Recovery System
U.L. Listed

How does it operate? Therma-Stor® III combines the features of an excellent heat recovery system with the best known water heating and storage technology. The lower 2/3 (79 gal.) are heated to a medium temperature water* by the hot refrigerant passing through the desuperheating plates that surround the storage barrel. The upper 1/3 (40 gal.) of water in the storage barrel is heated further by the use of a 4500-watt heating element to an adjustable, preset temperature (110°F-170°F). This electric element continues to maintain the output temperatures of the Therma-Stor® III during the compressor off times or when the demand for hot water exceeds the systems' production capacity.

Therma-Stor® III Application Specs

Therma-Stor® III can accommodate condensing loads of up to: 15 Ton — R-12; 30 Ton — R-22, R-502. The individual Therma-Stor® III circuits (2) can be connected in parallel or ganged for use on large tonnages.

*Temperature depends on system tonnage and time.



Therma-Stor® III Heat Recovery System Features . . .

1. Vertical dual circuit desuperheater plate welded and expanded for internal refrigerant passage.
2. 1-1/8" O.D. refrigerant inlets and outlets.
3. Industrial glass lined hot water storage tank.
4. 1-3/4" Foam-in-place urethane insulation.
5. Dual anode protection against corrosion for extended barrel life.
6. Water inlet and high-temp. outlet are 1-1/4" male Npt.
7. 150 PSI and 210°F. pressure/temperature relief valve.
8. 4500 watt low density electric heating element.
9. Adjustable thermostat (110°F-170°F) controlled heating element.
10. Attractive enameled galvanized external wrapper.
11. Medium temperature water out.
12. Maximum operating refrigeration pressure is 325 PSIA.

Other Features

- 119 gallon nominal water capacity.
- Double wall protection between refrigerant and water.
- Double normal water heating tank insulation.
- Dual vertical heat exchangers standard.
- Size 28" dia. 67" ht. 400 # in weight.

THERMA•STOR III Heat Recovery System

HOW MUCH HOT WATER DO YOU USE ?

Chart #1 shows the water temperature rise you can expect at any of the given compressor outputs and water usages.

FIRST, determine your hot water usage in gallons/hour (this can be estimated or measured).
SECOND, determine your compressor(s) output (in tons*).
THIRD, extend the compressor output line until it intersects the water usage line on the 'water heating chart'.
FOURTH, estimate the water temperature rise from the chart at the point of intersection.
FIFTH, to find the additional temperature rise from the heating element—simply extend the water usage line downward to intersect the 'heating element scale' below chart #1.
SIXTH, to determine the high-temperature water output you can expect from the Therma•Stor III with this system — add the temperature of the cold water supply to the total of the two temperatures determined on the chart (steps 4 & 5).

EXAMPLE 1: (refer to Chart #1)

given
- 7 Ton compressor(s) output
- 70 Gallon/hour water usage
- 60° Cold water supply temperature

then adding	60°F — Cold water supply temp.
	+65°F — Estimated water temperature rise (refer to A on Chart #1)
	+26°F — Water temp. rise from heating element. (refer to B on Chart #1)
equals	151°F — Total high-temp. water output

As you can see, with those given conditions, one Therma•Stor III can heat 70 gallons of 60° water to 151°F. If hotter water is desired, recalculate using two Therma•Stor III's (this doubles the heating plate area and heating element temperature rise).

IF YOU NEED HOTTER WATER...

FIRST, divide the compressor output and water usage by 2.
SECOND, plot information onto the water heating chart.

EXAMPLE 2: (refer to Chart #1)

given
- 3½ Ton compressor output (7 ÷ 2)
- 35 Gallon/hour water usage (70 ÷ 2)
- 60° Cold water supply temperature

then adding	60°F — Cold water supply temp.
	+70°F — Est. water temp. rise (refer to C on Chart #1)
	+52°F — Water temp. rise from heating elements (refer to D on Chart #1)
equals	182° — Total high-temp. water output

As you can see, the second Therma•Stor III adds 31°F to the high temperature water (5° from the plate area and 26°F from the additional heating element).

NEED HOT WATER STORAGE ?

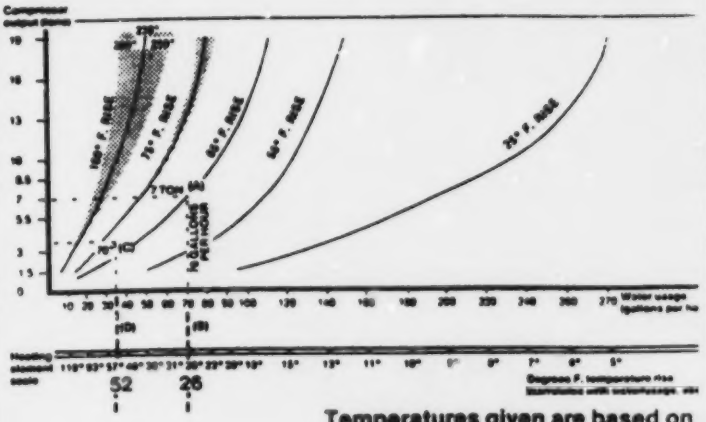
Chart #2 shows quantity of 100° rise water you can expect from different combinations of compressor output and running time (hours).

Any combination of capacity and running time that falls into the shaded area requires a refrigerant hot gas by-pass valve or an additional storage tank to avoid overheating water.

EXAMPLE 1 shows the amount (in gallons) of hundred degree water available at the end of 4 hours.

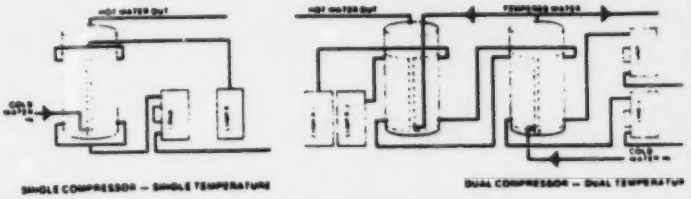
EXAMPLE 2 shows that the amount of hot water available has exceeded the 70 gallon limit. If the amount of hot water required during the 8 hours of operation is approximately 70 gallons, a hot gas bypass valve is recommended. If more than 70 gallons of hot water is required per batch, an additional storage barrel is recommended.

THERMA•STOR III WATER HEATING CHART — CHART 1



Temperatures given are based on cold water supply up to 65°F.

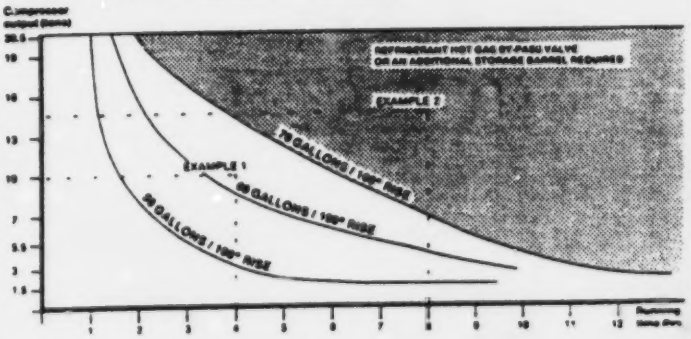
TYPICAL INSTALLATIONS



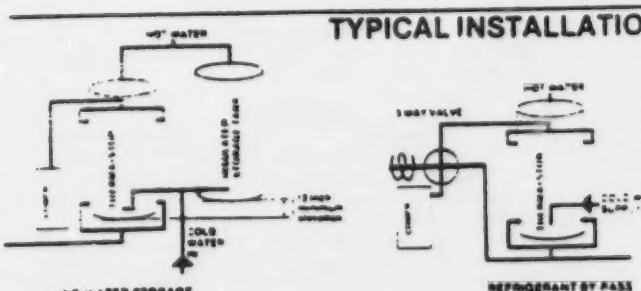
SINGLE COMPRESSOR — SINGLE TEMPERATURE

DUAL COMPRESSOR — DUAL TEMPERATURE

GALLONS OF 100° F RISE WATER AVAILABLE — CHART 2


REFRIGERANT HOT GAS BY-PASS VALVE OR AN ADDITIONAL STORAGE BARREL REQUIRED
EXAMPLE 2
70 GALLONS / 100° RISE
EXAMPLE 1
48 GALLONS / 100° RISE
70 GALLONS / 100° RISE

TYPICAL INSTALLATIONS



INSULATED STORAGE BARREL INSTALLATION

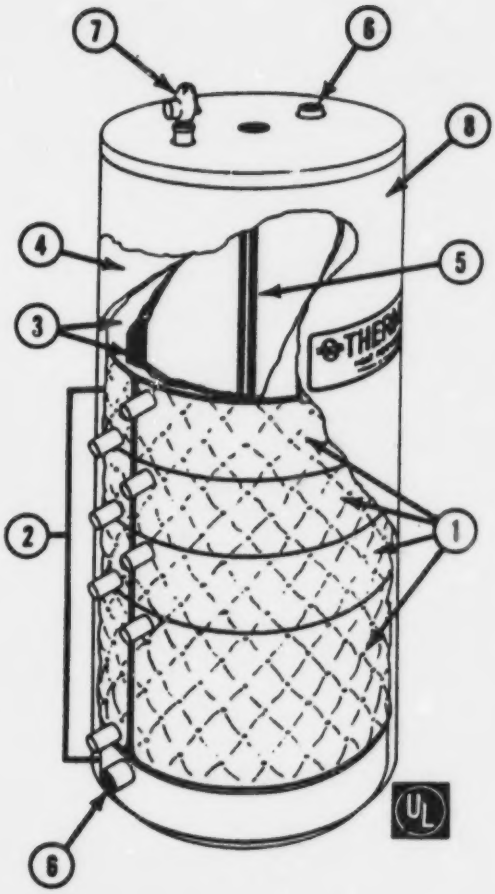
REFRIGERANT BY-PASS INSTALLATION

DEC

THERMA•STOR II

Heat Recovery Systems

Food Service Model



THERMA•STOR FEATURES . . .

1. Four-circuit, stainless steel desuperheater plates welded and expanded for internal refrigerant pass.

2. Refrigeration connections—upper three circuits' inle and outlets (7/8" O.D.S.), lower circuit inlet and outl (1-1/8" O.D.S.).
3. Industrial glass-lined hot-water storage tank
4. Urethane foam insulation
5. Magnesium anode
6. Water inlets and outlets (1-1/4" Female NPT)
7. 150 psi and 210°F pressure and temperature water relief valve.
8. Attractive water-resistant outer wrapper

OTHER FEATURES AND SPECIFICATIONS:

- Rated for 325 PSI refrigerant operating pressure
- 114 Gallon water capacity
- Double-wall protection between refrigerant and wat
- Size: 25" dia., 65" height, **370 lb. in weight.
- U.L. Listed

Food service establishments use large amounts of hot water along with conventional refrigeration in their everyday operations.

Now, with a Therma-Stor FSM, the heat generated by the hot refrigerant in your various condensing systems can be used to assist in the production of the hot water required in your establishment. The condensing systems found in cold storage boxes and ice machines are excellent heat sources for the Therma-Stor FSM. In some geographical locations or where building designs dictate, the air conditioning systems are also utilized.

The Therma-Stor FSM also serves as a desuperheater in the condensing system considering that the hot refrigerant gas from the system compressor is passed through the Therma-Stor prior to entering the condenser. The food service model Therma-Stor is equipped with four separate desuperheating circuits for maximum utilization of the available desuperheating loads.

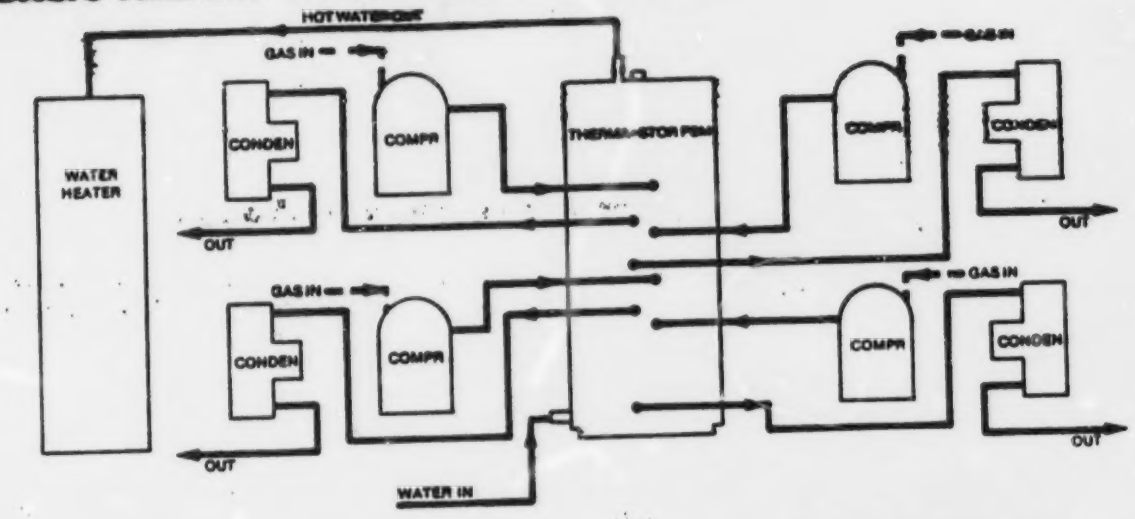
In applications where a Therma-Stor FSM is added to existing air-cooled refrigeration systems, the condenser fans may be cycled for head pressure control and additional energy savings.

APPLICATION SPECIFICATIONS

Therma-Stor FSM can accommodate condensing loads of up to 20 ton when utilizing R-22 or R-502, and 10 ton on R-12. The lower circuit has twice the capacity (40%) of each of the upper individual circuit (20%) loading capacity.

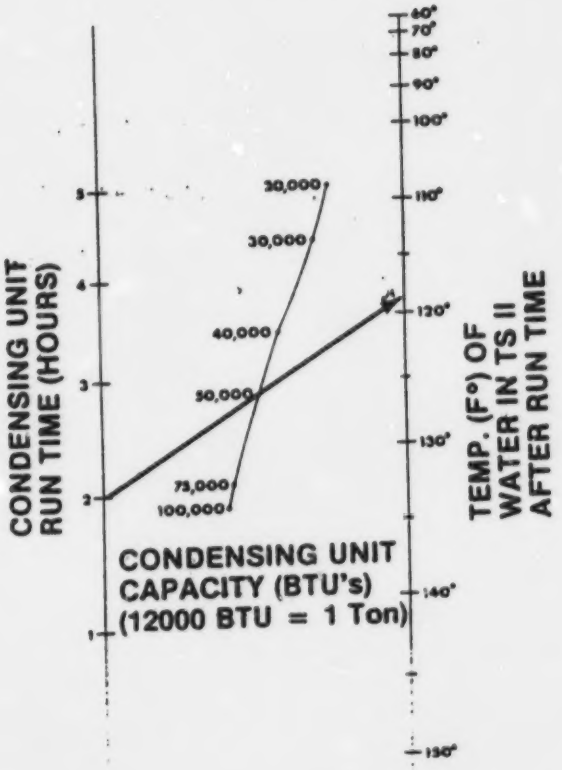
A check of the system's operating pressures and temperatures is recommended. Should the discharge gas temperature leaving the compressor reach 210°F, provisions to bypass the hot gas around the Therma-Stor and directly on to the conventional condenser should be incorporated in the system piping. This provision can be accomplished with the use of an aqua-stat in conjunction with hot gas bypass valves and other arrangements. A 1/2" NPT female coupling is provided near the top of the Therma-Stor shell for the recommended water temperature controllers.

BASIC THERMA • STOR II PSM INSTALLATION



WATER HEATING CHARTS

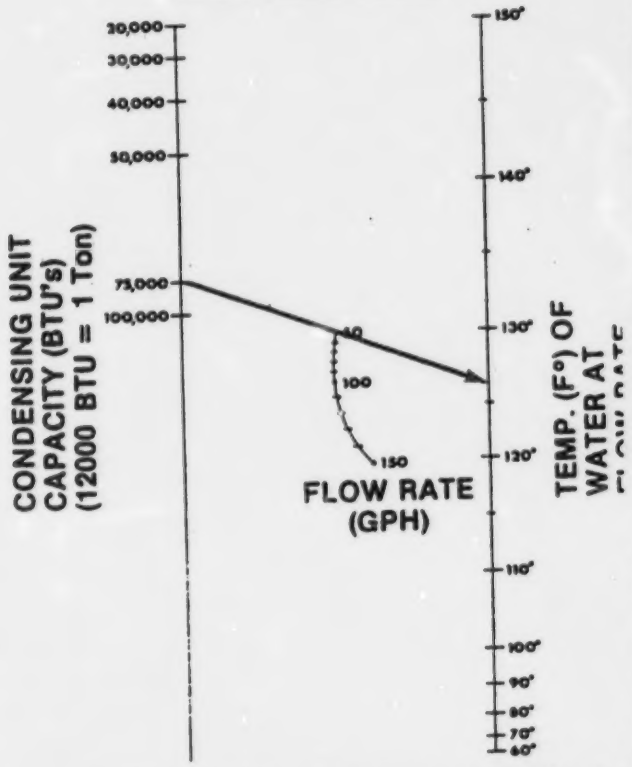
CALCULATIONS BASED ON:
1. 90° Ambient Temperature.
2. Suction cooled hermetic condensing units.
3. 10°F Superheat
4. 60° Cold Water Supply



To determine the temperature of the water in the T•S II barrel after a given time, draw a straight line from the "RUN-TIME" through the "CONDENSING UNITS CAPACITY" extending the line to intercept "TEMP. (F°) OF WATER."

The temperature arrived at is what can be expected if no water is used during run time.

EXAMPLE: 2 HOURS RUN TIME WITH A 50,000 BTU CAPACITY CONDENSING UNIT WOULD YIELD 118°F WATER (WITH THE GIVEN AMBIENT, ETC. CONDITIONS)



To determine the output temperature of the water at a given usage rate, draw a straight line from the appropriate "CONDENSING UNITS CAPACITY" through the "FLOW RATE" extending the line to intercept "WATER TEMP."

EXAMPLE: 75,000 BTU'S WITH A WATER FLOW RATE OF 50 GPH RESULTS IN 126°F WATER TEMPERATURE.

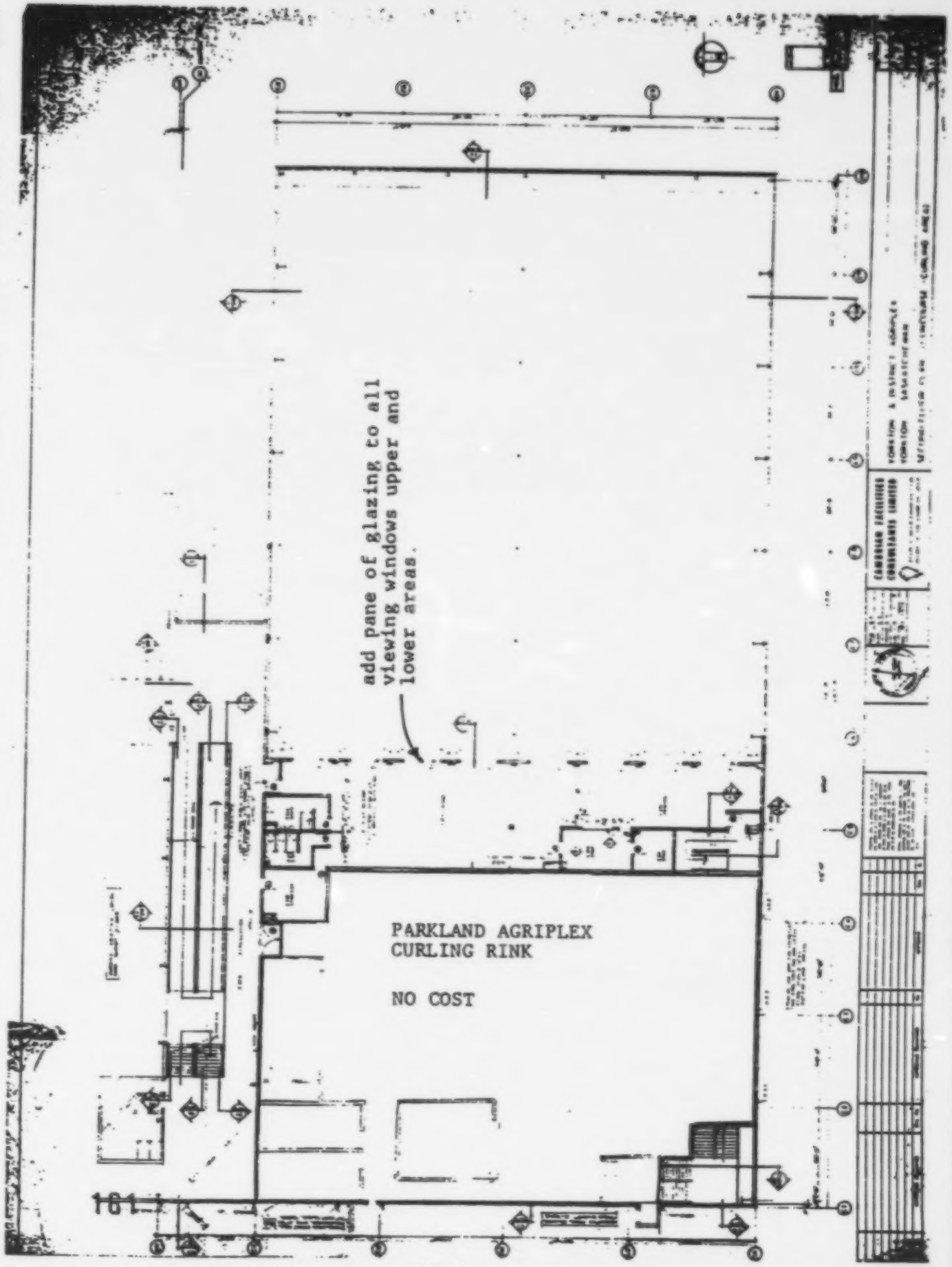
A. ARCHITECTURAL

CURLING RINK

NO COST

1. Check weatherstripping at exterior doors.

2. When the mechanical alternate of removal of electrical unit heaters is considered, we would suggest the installation of an additional pane of glass to the glazed walls. Cost should not exceed $6,300. Payback should be in 33 years.


add pane of glazing to all viewing windows upper and lower areas.
PARKLAND AGRIPLEX
CURLING RINK
NO COST
161

B. MECHANICAL

CURLING RINK

NO COST

1. Heating System/Night Set-Back:

The temperature in the curling area is being maintained at approximately 30°F minimum on a continuous basis.

We would propose adding a time clock or tying into an existing time clock to in fact shut the heat off completely during unoccupied periods of time.

During occupied times we feel that 29°F to 30°F is a reasonable space temperature, however, we feel that after-hours the temperature could be allowed to simply float.

The installation of a new time clock in this area would cost approximately $300 installed, however, the payback period would be approximately 50 hours of operation, with a savings of $6/hour during off hours.

2. Space Humidity Control:

At present the space humidity is controlled by operating two (2) wall mounted propeller exhaust fans. Raw outside air is drawn into the space via louvers on the opposite side of the rink. The fan operation is controlled by a time clock, the fans operating only during occupied times.

We would suggest the addition of a space humidistat to override the time clock, in that, the fans would operate only when required by high humidity.

Also, as part of this proposal, we would suggest the supply and installation of no-leak dampers on both the exhaust fan outlets and the fresh air intakes (see attached for product information).

During times that the fans are not in operation the infiltration through the openings in question would be kept to zero.

With the space presently being heated electrically, the cost to heat outside air entering this space on a yearly basis is approximately $2/cfm (see appendix "A").

If we assume a damper leakage of 10% during fan down time and if we assume fan down time will be approximately 60% of the heating season the saving would be as follows:

Savings $/hr = 4200 cfm/fan x 2 fans x 60% (fan downtime) x $2/year/cfm = $1,000.

Using a capital cost for the damper package, supplied and installed, of $2,500 the simple payback would be 2.5 years.

3. Antistratification Fans:

At present the space is heated with horizontal discharge type electric unit heaters.

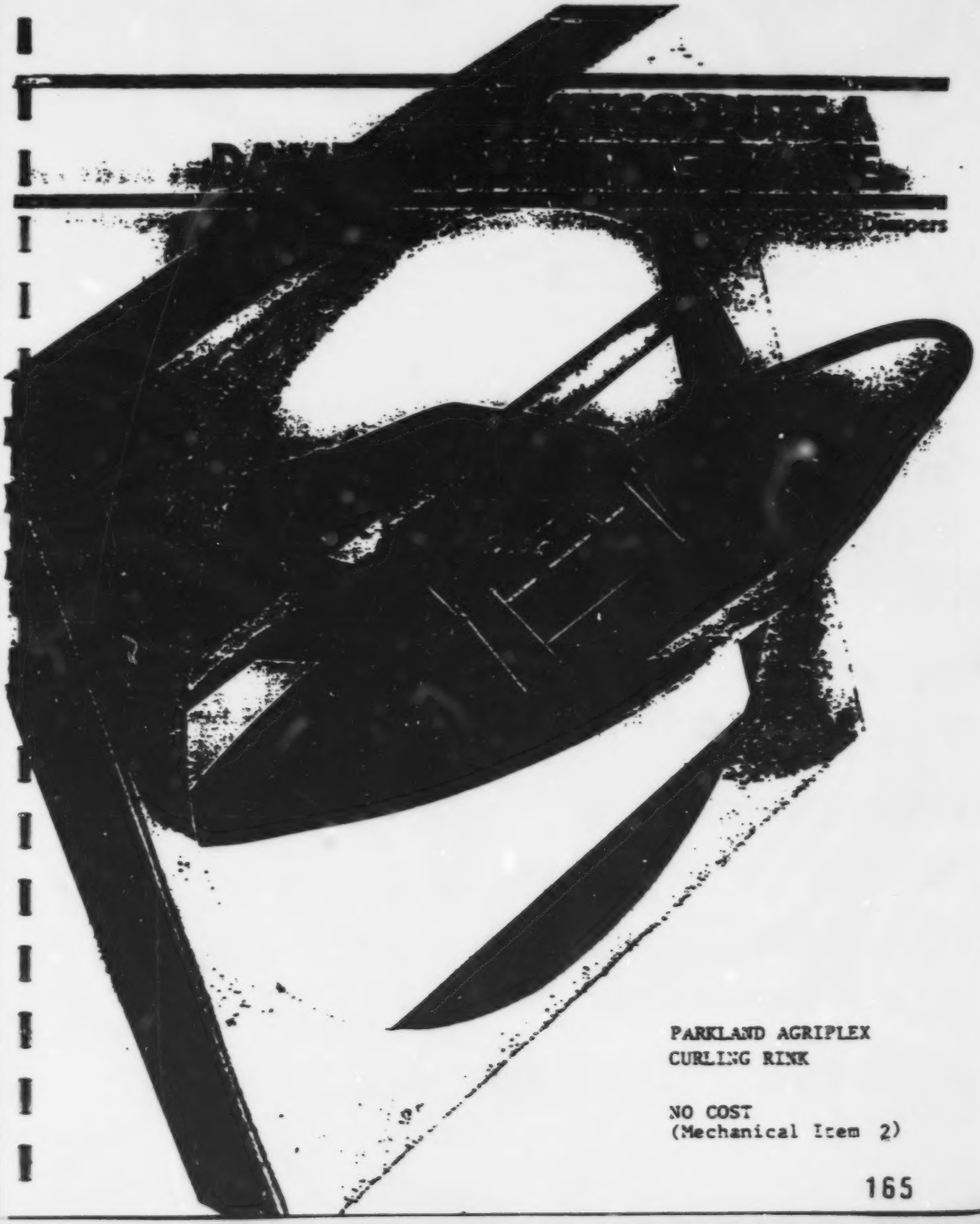
We would propose the addition of a number of ceiling mounted antistratification fans (see attached for product information).

In the past we have successfully used these units in curling rinks, normally two (2) units for every three (3) sheets of ice.

In this case with eight (8) sheets of ice, we would suggest the installation of six (6) fan units. The fan units would be complete with variable speed in order to control the air flow near the ice surface and would also be reversible rotation in order that the flow of air can be directed against the ceiling of the Curling Area to help prevent condensation on the roof support structure during certain times of the season.

The cost of the fans supplied and installed complete with controls would be approximately $3,000.

With the yearly space heating costs at $10,000 (see "Space Heating") and the fans advertised to save approximately 20% to 30% of the yearly fuel consumption the payback period would be approximately 2 years, however, because of the reduced space temperature (30°F as compared to a normal 70°F) we would suggest a realistic payback period of 4 or 5 years could be expected.



PARKLAND AGRIPLEX
CURLING RINK

NO COST
(Mechanical Item 2)

PARKLAND ARTIFEX

CURLING RINK

NO COST
(Mechancial Item 3)

A fan for all reasons

industrial • commercial
institutional • agricultural
residential • commercial • inst
strial • agricultural • residenti
institutional
industrial • insti
residential • industrial • commercial • agricu
residential • industrial • comm
dustrial • commercial • institu
tutional • agricultural • residen

Ceiling Fan Systems by WILCORP

B. MECHANICAL

CURLING RINK

LOW COST

1. Space Heating:

The present system of space heating in the Curling Rink includes 6 x 25 kW electric unit heaters that run continuously or as required to maintain a space temperature of approximately 30°F.

We would propose the addition of roof top gas fired heating units to replace the existing electric unit heaters. The N.B.C. prevents using open flame gas fired unit heaters within the space, so we have chosen two (2) gas fired roof top units to provide the required space heating.

Each unit would be sized at 300,000 BTU/hr and the supply air system would be complete with all required ductwork.

The installation of this heating system would cost approximately $24,000, however, with gas costs at $3/MCF and electrical energy at 4¢/KWH the gas fired system is considerably less expensive to operate.

Assuming that the existing electric unit heaters are sized properly to offset the building envelope heat loss and at the same time supply the required heat to raise the ventilation air to space temperature set point the following modified degree day energy consumption formula would apply:

$$E = \frac{(Hl \times D \times 24)}{(\text{Delta T} \times n \times V)} (Cd) (Cf)$$

Hl = Heat Loss = unit heat capacity = 150 kW
= 517,500 BTU/hr

D = Yorkton degree days = 10,850

Delta T = Temperature difference (design)
= $-40^{o} + 30^{o} = 70^{o}$

n = Rated full load efficiency = 1

V = Heating value of fuel = 3,413

Cd = Heat loss vrs degree days interim factor
= 0.43

Cf = Part-load factor = 1

$$E = \frac{517,500 \times 10,850 \times 24}{70 \times 1 \times 3,413} = 0.43 \times 1$$

E = 243,139 kWh/year

Space heating costs per year with the existing system are as follows:

243,139 kwh/year x \$0.04 = \$9,725/year.

By switching to a gas fired system the yearly heating costs would be as follows:

243,139 kwh/year x 3,413 BTU/kwh x $\frac{1}{1,000,000}$ BTU/mcf
x $\frac{100}{70}$ (eff. of gas fired equipment) x \$3.00/mcf = \$3,556.00

The new savings would be \$9,725 less \$3,556 = \$6,170/year. Using the figure of \$24,000 as the installed cost of the gas fired system the simple payback period would be approximately 4 years.

C. **ELECTRICAL**

CURLING RINK:

.1 Adopt a better lighting maintenance program to improve the light loss factor; adopt group relamping.

.2 Remove all louvers and lenses in areas where the additional glare can be tolerated. Where lenses are necessary to control glare use efficient types.

.3 Install additional switches to permit shutting off lights in unoccupied areas of the building.

.4 Replace incandescent luminaires with more efficient fluorescent or high pressure sodium fixtures.

.5 Provide light switches in all rooms to control fixtures in the room.

Cost Comparison:

Incandescent - replace the 38 incandescent fixtures with 20 fluorescent fixtures:

energy - 38 fixtures x .150 KW x $.0186 x 1684 hour = $178.53

demand - 38 fixtures x .150 KW 1 $6.65 x 12 months = $454.86

$633.39

+ 10% surcharge + 5% E & H Tax = $731.57

Lamp replacements: $38 \times \frac{1684}{1500} \times \$1.60 = \$68.26$

Labour: $38 \times \frac{1684 \text{ hour}}{1500 \text{ hour}} \times .1 \times \$15.00/\text{hour} = \$63.99$

Annual incandescent cost = $863.82

Fluorescent - operating cost for 20 fixtures:

energy - .095 x 20 x $.0186 x 1684 = $59.51

demand - .095 KW x 27 x $\frac{\$6.65}{KW}$ x 12 months=$204.68

+ 10% surcharge + 5% E & H Tax = $305.15

Lamps - $.50 x 2 lamps x 20 fixtures = $20.00

Annual cost = $325.15

Annual savings for fluorescent versus incandescent

= 863.82 - 325.15 = $538.67

Cost to remove incandescent and replace with fluorescent = $20.00 x $70.00 = $1,400.00

Payback = $\frac{\$1,400.00}{\$538.67}$ = 2.59 years.

B. MECHANICAL

CURLING RINK

NEW AND INNOVATIVE

1. Water Treatment:

The water presently being used for the ice surface, both initial and for flooding purposes is standard City of Yorkton domestic tap water.

We are proposing to add a Water Treatment Unit to clean up some of the impurities normally found in the municipal water supply. The water being produced by the proposed Water Treatment Unit will produce a much superior ice surface, one that is easier to maintain, and one that is less energy to keep in a frozen condition.

The actual unit proposed will be sized to supply water for the Arena, the Curling Rink, and the Pool Make-Up Water. The increased size of the basic unit to supply the Curling Area would be approximately $7,000. The manufacturer of the Water Treatment Unit has conducted tests on Yorkton water and makes the claim that due to the reduced power consumption required to freeze the Curling Rink ice the $7,000 capital cost would be paid back in approximately 4 years.

This proposal is dependent on the main water treatment unit being approved for the arena portion of this project.

2. Space Heating/Waste Heat:

At present the Curling Area is heated by means of electric unit heaters. We have suggested the conversion to gas fired units to assist with Energy Conservation, however, the following proposal would be even better than the gas fired units in saving energy.

We are proposing that the Curling Rink be heated with waste heat from the refrigeration equipment located in the mechanical room adjacent to the Arena.

The heat exchanger required to reclaim the waste heat is discussed in the Arena portion of this Report, however, the Curling Area heating system would consist of six (6) horizontal discharge type hot water unit heaters. Ethylene Glycol would be used as a heat transfer fluid rather than the normal water which would require the addition of a heat exchanger and a circulation pump to the heating system.

The Curling Rink portion of this proposed heating system would cost approximately $20,000. We would suggest that the existing electric unit heaters be left as installed and act as backup to the new heating system.

We would estimate that waste heat from the refrigeration system will be available approximately 70% of the time.

With the existing electric heat operation cost of $9,725 per year and the installed cost of the 70% efficient heat reclaim system at $20,000 we would expect a payback period of approximately 3 years.

We must keep in mind that this proposed system is dependent on the main heat reclaim unit being approved for installation as described in the Arena portion of this Report.

CONVENTION / CONCOURSE

A. ARCHITECTURAL

CONVENTION AREA/CONCOURSE

NO COST

We recommend that under the normal maintenance program all the weatherstripping and doorsweeps be adjusted or replaced to provide an effective barrier against infiltration.

B. MECHANICAL

CONVENTION AREA/CONCOURSE

NO COST

1. Night Set-Back:

All areas to be complete with night set-ba[illegible]rmostats in order to lower the space temperature [illegible]y unoccupied hours. This would cost apr[illegible]150 per thermostat, supplied and installed.

According to computer runs being advertised by and available from the controls manufacturer, night set-back for an 8 hour period can reduce energy costs by approximately 7% on a yearly basis.

Approximately four thermostats are involved for a total installed cost of $600.

2. Exhaust Fans

All washroom and kitchen exhaust fans are complete with manual controls.

We would estimate that the exhaust fan operation could be decreased by 10% on a yearly basis.

With the total installed exhaust fan capacity in this area at 8,850 cfm the yearly savings would be:

8,850 cfm x 10% x $1/cfm/year = $885/year.

With the capital cost at $250 the simple payback would be 3 to 4 months.

3. Make-Up Air Unit MU-1

At present make-up air unit MU-1 supplies tempered 100% outside air to the pool washroom area and to the Concourse Area, both upper and lower floor.

Due to problems with negative pressure being encountered in the mechanical fan room the unit MU-1 is being run continuously, even during winter operation.

The unit involved is an Engineered Air Model HE-201 at 15,000 cfm. In order to overcome the need to run this unit during unoccupied periods we would recommend a total air balance of all the fans that make up the building ventilation and exhaust systems.

The cost of the air balance would be approximately $5,000.

The energy saved by shutting down the make-up air unit, say 50% of the time, would be as follows:

Total energy used on a yearly basis calculated by using the modified degree day method is:

$$E = \frac{(1{,}782{,}000 \text{ BTU/hr} \times 10{,}850 \text{ degree days} \times 24)}{(110 \times 1 \text{ (direct fired)} \times 1{,}000)} \times 0.43 \times 1$$

$= 1{,}815{,}696 \text{ ft}^3\text{/year}$

$= 1{,}815 \text{ MCF} \times \$3.00 = \$5{,}445\text{/year}$

By running this unit 50% of the time we could save approximately $\frac{\$5{,}445}{2} = \$2{,}700\text{/year}$

This amount of energy savings would pay for the Air Balance ($5,000) in approximately 2 years, assuming we can shut the make-up air unit down approximately 12 hours a day.

A. ARCHITECTURAL

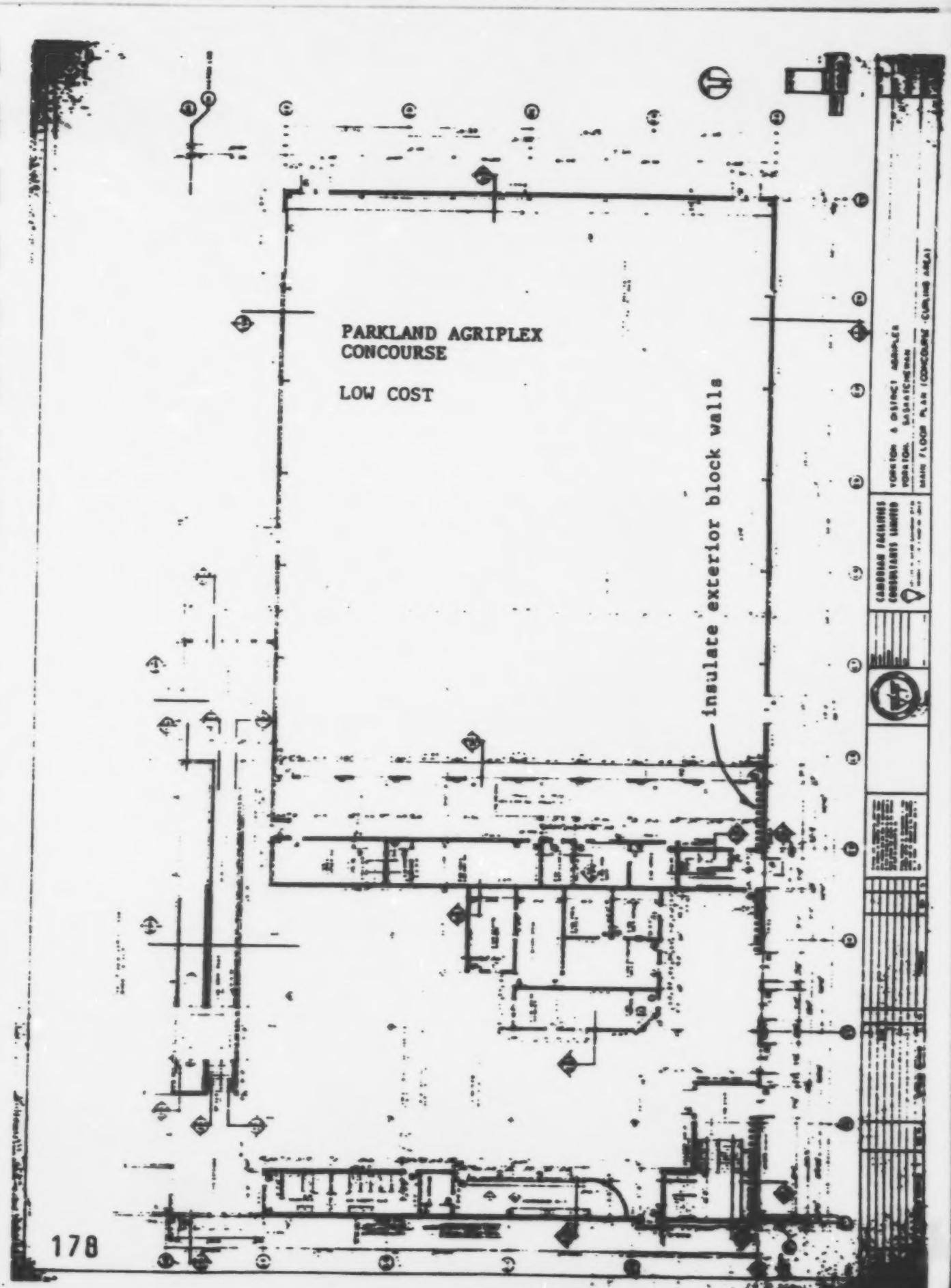
CONVENTION AREA/CONCOURSE

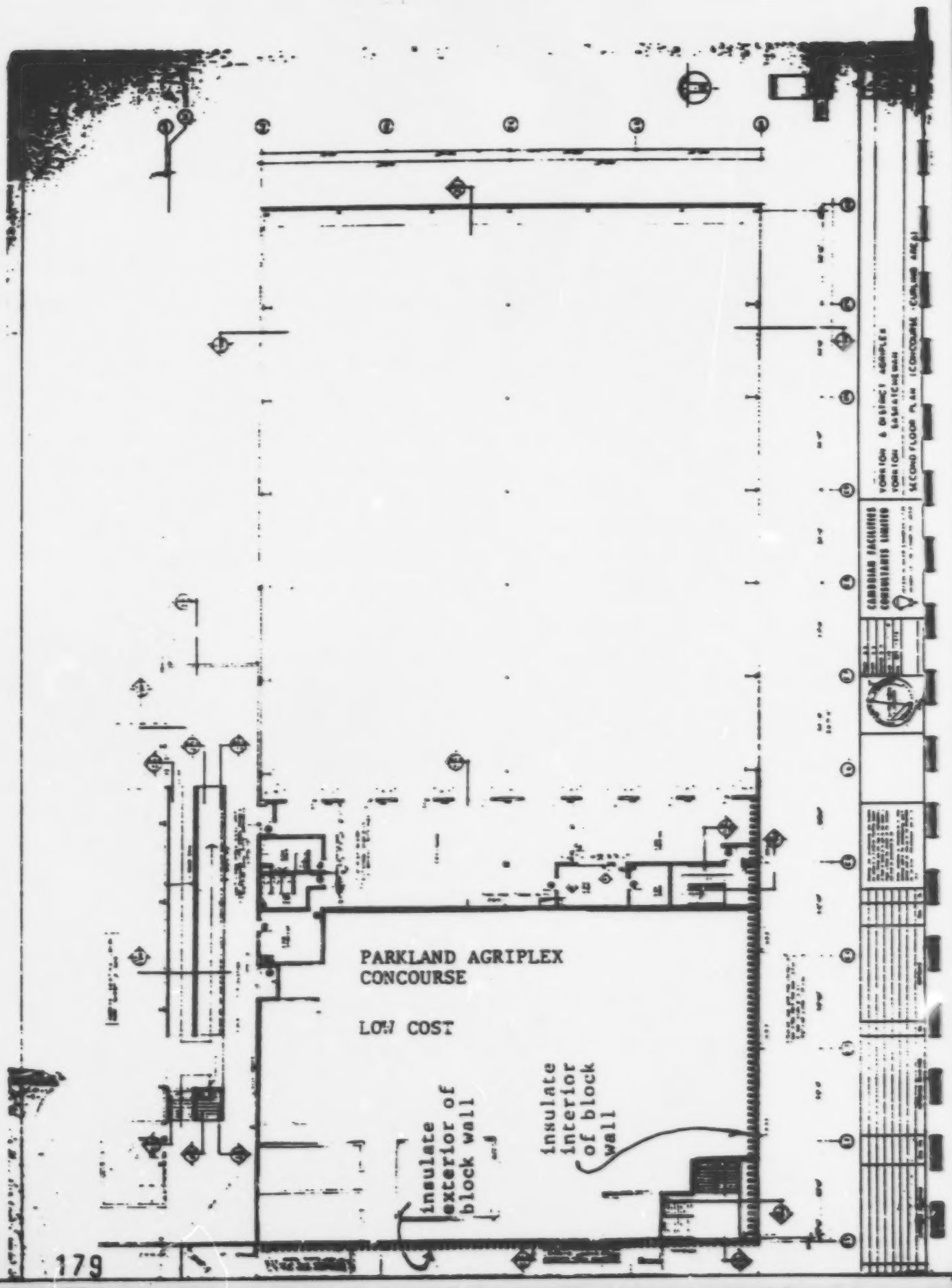
LOW COST

Upon visual inspection of the roof/wall junction, it was noted that the ceiling tiles had a layering of vermiculite block insulation. It would seem that some leakage exists in the exterior concrete block areas. The thermal scanning also revealed (photos 18 and 19) thermal bridging in the wall and heat loss at the wall/roof junction.

Because of the decorative aspect of the south wall, we would recommend that this side of the building be insulated on the interior and the west wall on the exterior (as the pool and arena).

The interior work should consist of the addition of 2" rigid insulation vapor barrier plaster board and oil base paint, exterior work should be 2" insulation and stucco. The cost of this work should not exceed $14,000. Probably annual saving of 141,294 MBTU or $425. Payback period could be 32.9 years.


PARKLAND AGRIPLEX
CONCOURSE
LOW COST
insulate exterior block walls


PARKLAND AGRIPLEX
CONCOURSE
LOW COST
insulate exterior of block wall
insulate interior of block wall

c) ELECTRICAL

CONVENTION/CONCOURSE

Lobby and Entrance

From lighting summary the light levels are high. We recommend to replace all incandescent fixtures, two for one and remove approximately ½ of the fluorescent fixtures.

.1 Installing a non-uniform lighting system based on using levels of illuminance required as per IES Standards for task, general and non-critical area lighting.

.2 Adopt a better lighting maintenance program to improve the Light Loss Factor; adopt group relamping.

.3 Remove all louvers and lenses in areas where the additional glare can be tolerated. Where lenses are necessary to control glare use efficient types.

.4 Provide manual switches or photo-cells to shut off lights when available daylight is adequate to replace the required lighting.

.5 Replace incandescent luminaires with more efficient fluorescent or high pressure sodium fixtures.

Cost Comparison:

If all the incandescent filtures (53) are replaced with 27 fluorescent fixtures.

Energy-53 fixtures x .150 KW x $\frac{\$.0186}{\text{KW Hour}}$ x

3816 hour = $564.27

Demand-53 fixtures x .150 KW x $\frac{\$6.65}{\text{KW}}$ x 12

months = $\frac{\$634.41}{\$1,198.68}$

$1,198.68 + 10% surcharge + 5% E&H Tax = $1,384.47.

Energy usage of incandescent fixtures=$1,387.47.

Incandescent lamp replacements: Lamp life = 1500 hours.

Annual = 53 lamps x $\frac{3816 \text{ hours}}{1500 \text{ hours}}$ x $1.60 lamp

cost per year = $215.73.

Labour = 53 lamps x $\frac{3816 \text{ hours}}{1500}$ x .1 hour/lamp

x $15.00/hour = $202.25.

Annual incandescent operating cost = $1,384.47 + $417.98 = $1,802.45.

Operating cost for 27 fluorescent fixtures:

energy - .095 KW x 27 fixtures x $.0186 x 3816 hour = $182.05.

demand - .095 KW x 27 filtures x $\frac{\$6.65}{\text{KW}}$ x 12

months = $\frac{\$204.69}{\$386.74}$

$386.74 + 10% surcharge + 5% E&H Tax= $446.69

Annual fluorescent lamp replacement cost = $.50 x 2 lamps x 27 fixtures = $27.00

Annual cost = $446.69 + $27.00 = $473.69

Annual savings incandescent cost - fluorescent cost = $1,802.45 - $473.69 = $1,328.76

Cost to remove two incandescent fixtures and replace with one fluorescent filture = $70.00 each x 27 = $1,890.00

Therefore payback period = $\frac{\$1,890.00}{\$1,328.76}$ = 1.42 years

To delete ⅓ of the fluorescent fixtures in the lobby.

Annual cost savings = ⅓ x (46 + 6) x $\frac{1}{27}$ x $473.69 = $456.14

Conference and Kitchen Areas:

.1 Lighting is good. the incandescent fixtures are difficult to change as fluorescent fixtures will not suit the function in this area.

.2 Replace existing lamps to energy saving type when they are due for replacement only.

RECOMMENDATIONS

RECOMMENDATIONS

Virtually all items identified in each retrofit category and for the four areas of the complex are included in this recommendation. Some items are of significant capital cost, however, all the theoretical simple payback periods are good, ranging from 50 hours on the short term to 33 years for the longest, with most in the 6 month to 5 year period.

A summary of all recommended items is listed as follows (numbers refer to items in detailed report):

POOL - No Cost Items

A. Architectural:

1. Weatherstrip and sweeps (maintenance item)
2. Sealants (maintenance item)
3. Pool Blanket - $3,000
   - payback reasonable (indeterminate)
4. Replace exterior door - $300
   - payback reasonable (indeterminate)
5. Paint Walls - no payback identified.
6. Insulate bond beams -cost $7,000 payback 4.5 years.

B. Mechanical:

1. Shower head flow restrictors. 7o hrs payback.
2. Time clock on pump - $250
   - 70 day payback
3. Time clock and damper for washroom exhaust
   - $1,200
   - 1 year payback
4. Antistratification Fans
   - $2,400
   - 4 year payback
5. Time clock and controls for temperature and humidity - $2,000
   - 1 year payback
6. Heat reclaim (see arena also)
   - $2,000
   - 260 hr payback
7. Gas fired whirlpool heater
   - $1,000
   - 1333 hrs payback on full load operation
8. Exhaust Dampers - $6,000
   - 12 years payback

C. Electrical

1. Fixture changes -$1,125
   -1½ year payback

POOL - High Cost Items

A. Architectural:

1. Exterior skin insulation
   - $32,200
   - 21 year payback

2. Roof Insulation - $16,700
   - 15 year payback

(note that both of the above must take place at the same time in order to maximize the benefits).

B. Mechanical:

1. Dehumidification - $80,000
   - 8 year payback

POOL - New and Innovative

B. Mechanical

1. Make-up water - $ 1,000

The total identifiable recommended estimated costs for the Pool area is $156,175 (Note that certain items have not been estimated as the scope is indeterminate at this time or they are classed as routine maintenance items.)

ARENA - No Cost Items

A. Architectural:

1. Weatherstrips and Sweeps (maintenance item)
2. Sealants (maintenance item)
3. Painting at change rooms, etc.
   - $4,700
   - payback indeterminate.
4. Add doors to fan rooms - $1,500
   - payback indeterminate

B. Mechanical:

1. Melt pit - $300 payback 4 months
3. Time clock for change room exhaust fans
   - maintenance
4. Night set back - $500
   - payback 8 months
5. Antistratification fans - $4,000
   - payback 3 years
6. Dampers - $3,600
   - payback 4 years

C. Electrical:

1. Public Area - fixture changes
   - $5,100
   - payback 2.65 years.

ARENA - Low Cost Items:

C. Electrical:

1. 400 watt HPS fixtures - $12,000
   - payback 2.8 years

ARENA - High Cost Items:

A. Architectural:

1. Interior Insulation - $22,000
   - payback: less then 12 months

2. Exterior Insulation - $25,200
   - payback 3.2 years

with natural gas combined items 1 & 2 would have a total payback of 1.35 yrs.

ARENA - New and Innovative:

B. Mechanical:

1. Jet Ice - $22,000
   - payback 5 years.

   (note that this will also vastly improve the quality of the ice surface.)

2. Heat reclaim from compressor
   - $85,000
   - payback 4 years

The total identifiable recommended estimated costs for the Arena area is $185,900 (note that certain items have not been estimated as the scope is indeterminate at this time or they are classed as routine maintenance items.)

CURLING RINK - No Cost Items

A. Architectural:

1. Weatherstrip and sweeps. (maintenance items)

2. Glazing at viewing area - $6,300
- payback 33 yrs.

B. Mechanical:

1. Night setback - $300
- payback 50 hours

2. Humidity control - $2,500
- payback 2.5 years

3. Antistratification fans - $3,000
- payback 5 years.

CURLING RINK - Low Cost Items

B. Mechanical:

1. Space Heating (Roof Top Units)
- $24,000
- payback 4 years.

CURLING RINK - New and Innovative

B. Mechanical:

1. Jet Ice (see also Arena) - $7,000
   - payback 4 years

   (note that this will also vastly improve the quality of the ice surface)

2. Waste heat recovery from compressor (see also Arena)
   - $20,000
   - payback 3 years.

The total identifiable recommended estimated costs for the Curling Rink area is $63,100 (note that certain items have not been estimated as the scope is indeterminate at this time or they are classed as routine maintenance items).

CONVENTION/CONCOURSE - No Cost Items

A. Architectural:

1. Weatherstrip, sealants and sweeps (maintenance items)

B. Mechanical:

1. Nite setback - $600
   - payback indeterminate

2. Time clock for fans - $250
   - payback 3-4 months

3. Air balance - $5,000
   - payback 2 years.

C. Electrical:

1. Lamp fixture changes -$1,890 payback 1.42 years

CONVENTION/CONCOURSE - Low Cost Items

A. Architectural:

1. Wall insulation - $14,000
   - payback 32.9 years

The total identifiable recommended estimated costs for the Convention/Concourse area is $ 21,740 (note that certain items have not been estimated as the scope is indeterminate at this time or they are classed as routine maintenance items.)

The total identifiable costs for all the items recommended are thus:

Pool	$156,175
Arena	185,900
Curling Rink	63,100
Convention Concours	21,740
	$426,915

Taking into consideration design fees, contingencies, escalation factors, financing charges and the like we would estimate that a total cost for the work would be about $ 500,000.